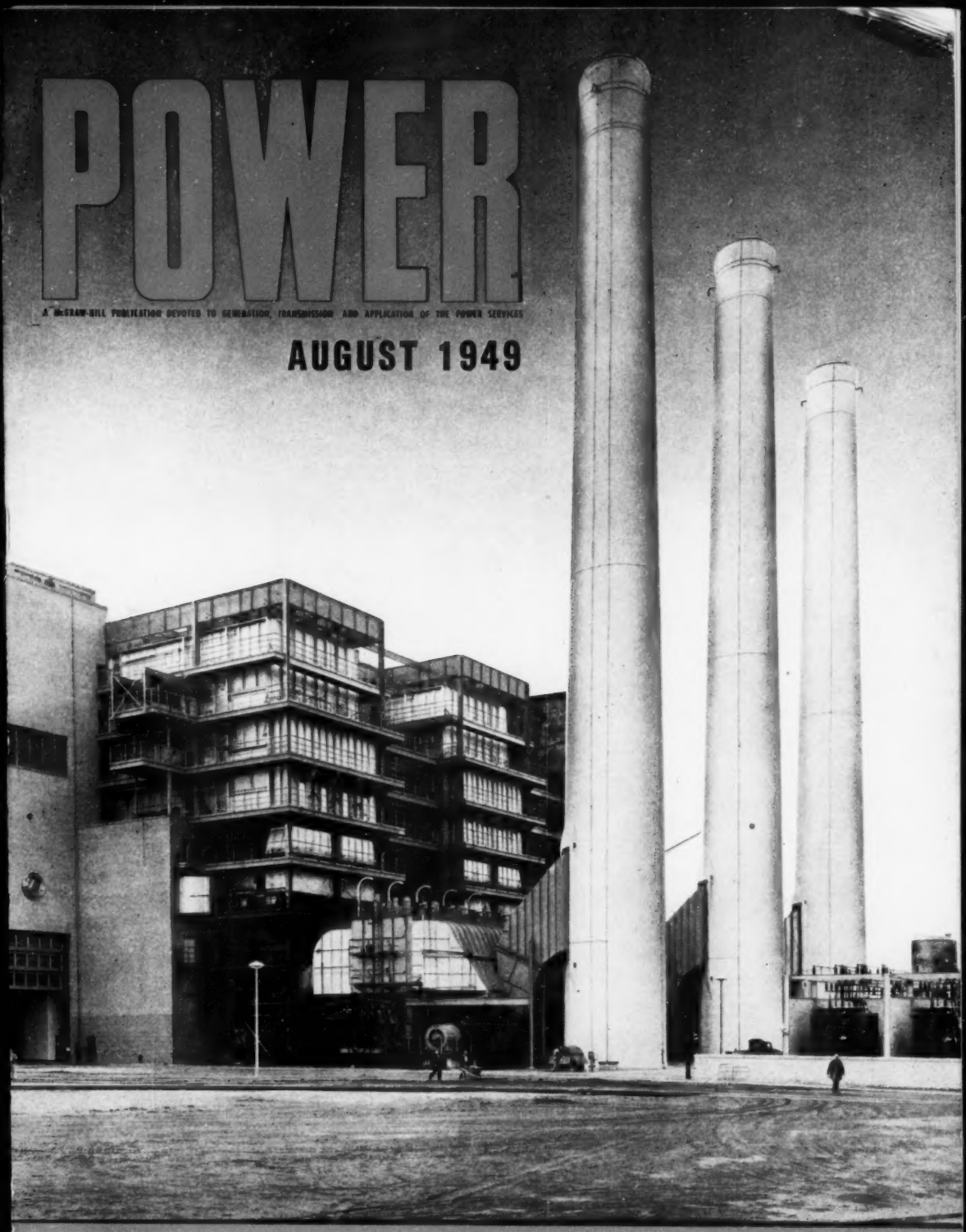
POWER

A McGRAW-HILL PUBLICATION DEVOTED TO GENERATION, TRANSMISSION AND APPLICATION OF THE POWER SERVICES

AUGUST 1949



IN THIS ISSUE: What the operator needs to know about dust collection — a new series, p 76; practical experience with quick-starting of boilers and turbines, p 82; first worldwide survey of gas-turbine installations reveals over 60 units being built or operating, p 95; details of newest industrial, utility plants, p 72, 98. **CONTENTS, p 67**

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As Dependable and Automatic as "Old Faithful"

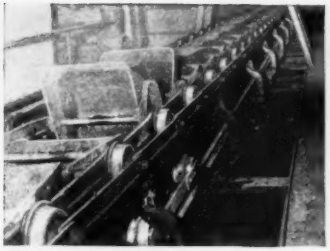
Every 65 minutes, dependable, automatic, "Old Faithful," the most famous of Yellowstone's geysers, throws a column of water into the air to the height of 95 to 130 feet and continues its eruption for 4½ minutes. This phenomenon of nature is so unbelievably automatic that it would appear to have a push-button control—the kind of control that automatically operates Hydrovac, the modern dust handling system. Once the Hydrovac System is started, dust valves open and close in regulated sequence, the system skips over boilers off the line, warns of unusual conditions, tells what is happening all the time, and closes down when all dust is removed. Final dust disposal may be to sump, bin or fill. May our nearest representative show you how dependable, Automatic Hydrovac can pay for itself in a short time? Write us.

HYDROVAC *Dust Handling*

ALLEN-SHERMAN-HOFF CO., 227 S. 15th ST., PHILADELPHIA 2, PA. ***Offices & Representatives in Principal Cities***

POWER (with which are consolidated "Science and Industry," "The Engineer Review," "The Engineer," "The Stationary Engineer"), Aug., 1949, Vol. 93, No. 8 Published monthly with an additional Directory number in June. McGraw-Hill Publishing Company, Inc. Editorial and executive offices, 330 W. 42nd St., New York 18, N. Y. Entered as second class matter January 26, 1949, at the post office at New York, N. Y., under the act of March 3, 1879. Printed in U. S. A. Allow at least 10 days for change of address. Subscription rates, U. S. and U. S. possessions, $5 for one year, $7 for two years, 50c per single copy. Canada, $6 for one year, $9 for two years. Pan American Countries, $10 for one year, $16 for two years. All other countries $15 for one year, $25 for two years. Please indicate position and company connection on all subscription orders.

LINK-BELT COAL & ASHES HANDLING MACHINERY

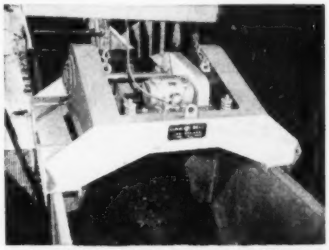


PECK CARRIER

An overlapping type pivoted bucket carrier for handling both coal and ashes in one unit.

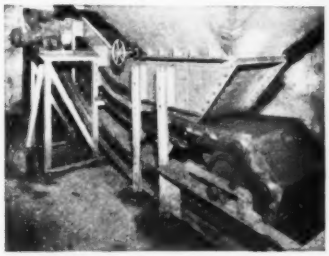
STACKERS

A type and size for any storage capacity.



CAR SHAKERS & UNLOADERS

A type and size for the rapid and economical unloading of coal or similar materials from hopper bottom cars.



FEEDERS

Available in apron, chain, bar, belt, oscillating, reciprocating, screw and vibrating types for coal and other materials.

Link-Belt Standard Units plus specialized "know-how" for integrating them into operations for high efficiency, high production and low operating costs, are backed by more than 70 years of experience.

We welcome the opportunity to serve you. Catalogs on any product will be sent on request.

Other Link-Belt products, not illustrated, include Bulk-Flo Elevator-Conveyor-Feeders . . . Coal Crushers . . . Rotary Car Dumpers . . . Weigh Larries . . . Unloading Towers . . . Silo Systems . . . Bunkers . . . Gates . . . Hoppers . . . Traveling Water Intake Screens . . . Ball, Roller and Babbitted Bearing Pillow Blocks . . . Clutches . . . V-Belt Drives . . . Shaft Couplings, etc.

11,553

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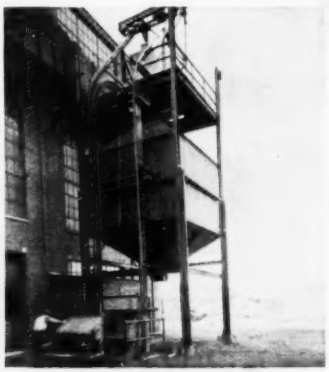
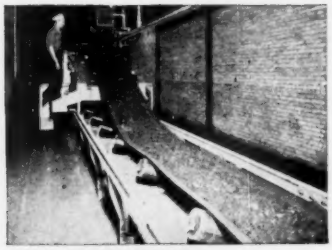
Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Houston 3, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8. Offices in Principal Cities.



SKIP HOISTS

For all capacities and lifts, elevating coal, coke, ashes, etc., at low cost.



BELT CONVEYORS

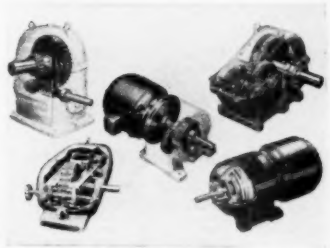
The reliable and flexible conveyor for handling large capacities at greatest economy.

YARD STORAGE

Various storage and reclaiming systems have been designed for efficient and low cost operation.

BUCKET ELEVATORS

Available in a number of standard types to meet your particular condition.



ENCLOSED DRIVES

Gear Drives, Gearmotors, Fluid Drives, Variable Speed Drives, Chain Drives, etc. for the efficient transmission of power.

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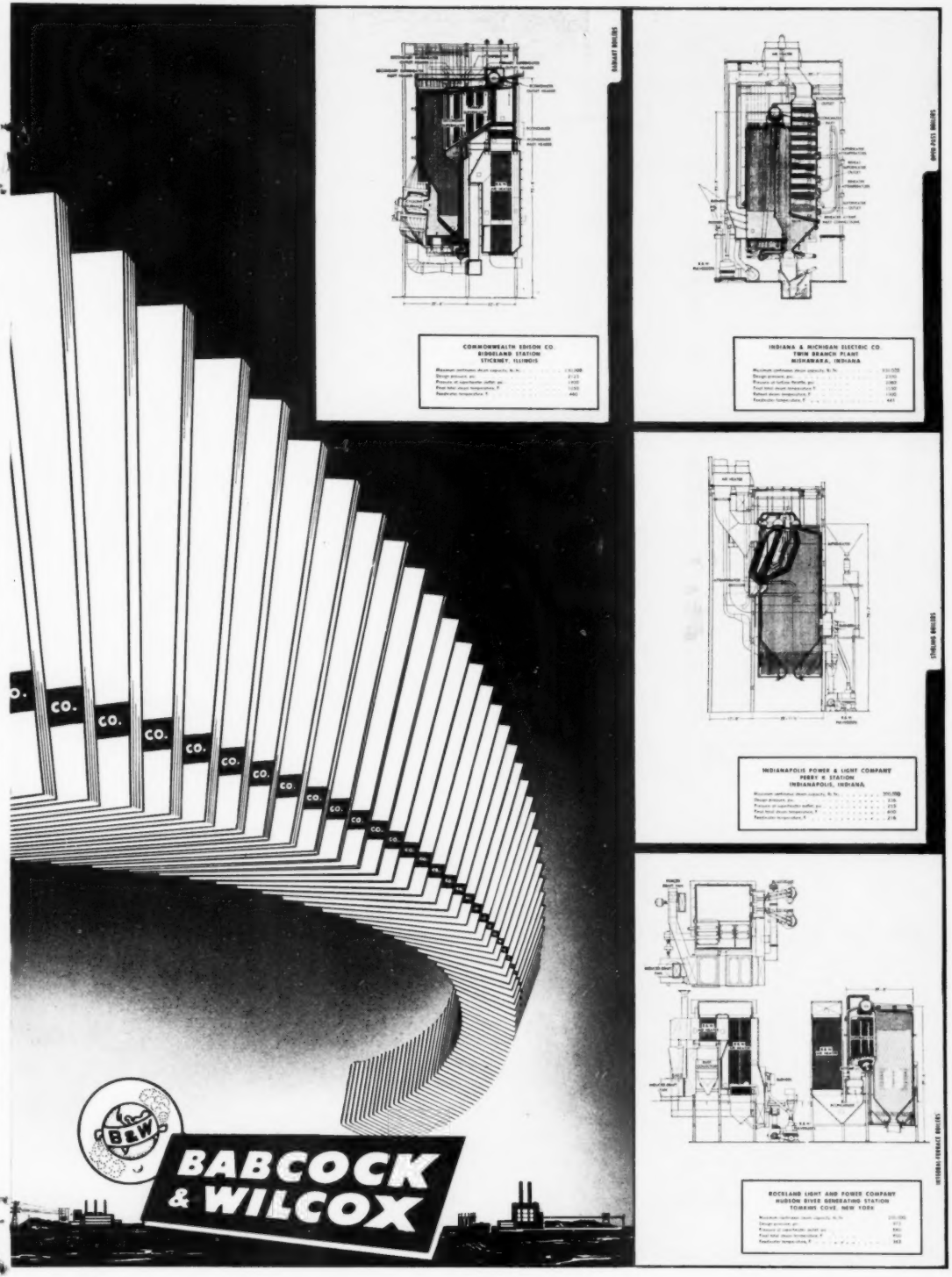
for Stepping Up America's Power

Between the covers of this new edition of "Central Station Boilers" are salient facts about recent B&W designs that are helping to make power more plentiful all over America. Typical units are presented in detailed drawings with their capacities and pressures conveniently tabulated along with names of power companies and station locations.

Send for your copy today. Simply ask for Bulletin G-67.
The Babcock & Wilcox Co., 85 Liberty Street, New York 6, N. Y.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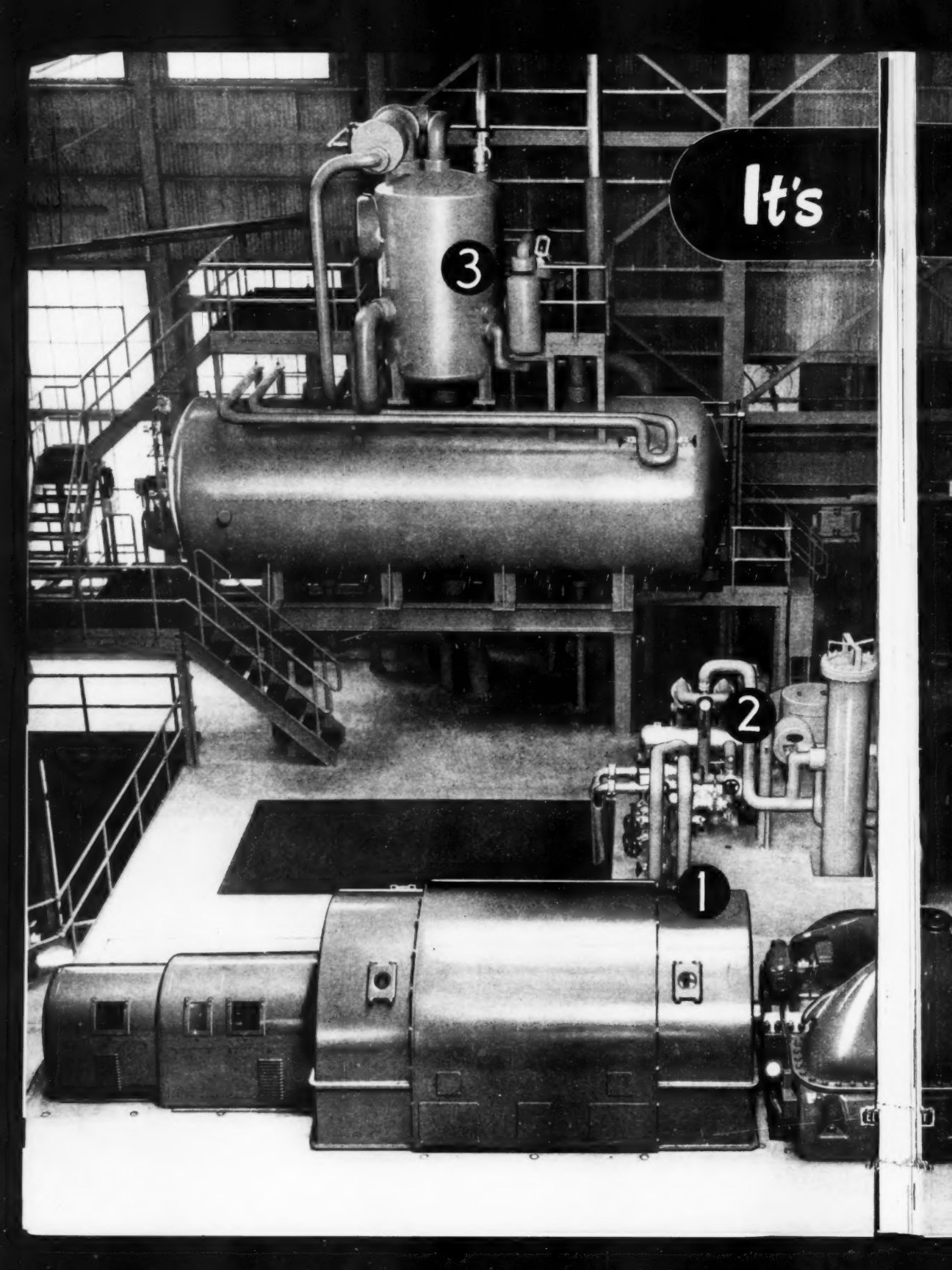
It's
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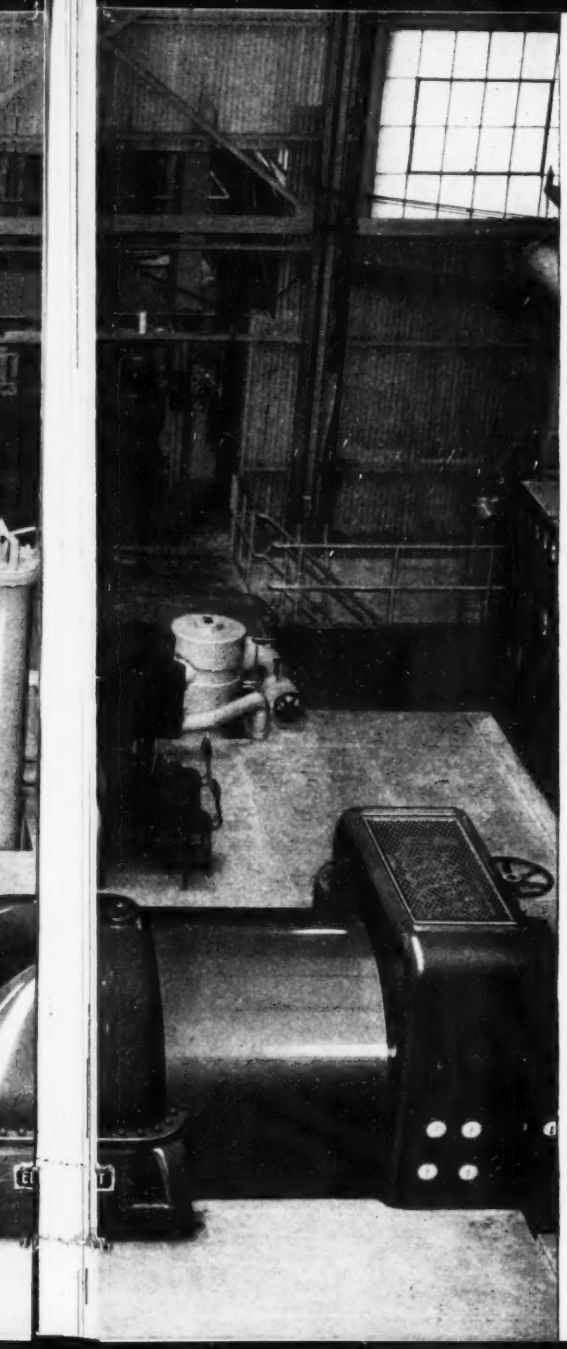
Elliott wherever you look



❶ In the foreground, an Elliott turbine-generator unit — clean-lined, businesslike, and all-Elliott throughout . . .

❷ Just back of the turbine-generator, an Elliott twin two-stage steam jet ejector which serves the Elliott surface condenser under the main turbine . . .

❸ In the background, the Elliott vertical deaerating feedwater heater mounted on its horizontal storage tanks, unsleeping sentinel against corrosive elements in the boiler feedwater . . .

And not shown in the photo, but definitely in the picture of operating economy, is an Elliott evaporator preheater quietly and faithfully performing its function.

This plant, generating at 13.8 kv, with 600 psi, 825 F steam conditions, is typical of a score of utility installations where Elliott equipment has gone into service recently.

Here is team-work at its best. You'll find it wherever Elliott equipment gets together.

Complete data on any of this equipment mailed at your request.

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Better BOILER CLEANING

WHEN YOUR SOOT BLOWERS HAVE AIR HEADS for AIR BLOWING

Full benefit in improved cleaning and lower cost is not realized from the inherent advantages of air blowing unless the differences between air and steam as a cleaning medium are taken into account. For example, the very high flow rates required by multiple nozzle elements permanently installed in the furnace dictate the use of heads especially designed for air blowing.

The two heads shown here were designed and are used exclusively for air cleaning. They have a much lower pressure drop than have any heads originally designed for steam but also used for air. As a result higher flow is attained, more of the available energy goes into soot blowing and there is a saving in the kwhr required by the air compressor.

These exclusive air heads have another important advantage . . . they make it possible to use the air puff blowing principle. Here the cleaning is done by a series of short puffs separated by intervals to recharge the air receiver. The compressor and receiver are thus much smaller and require less investment than would otherwise be the case. Additional benefits are cleaning while boiler is on automatic operation, and avoidance of atmospheric soot nuisance where dust collectors are not used.

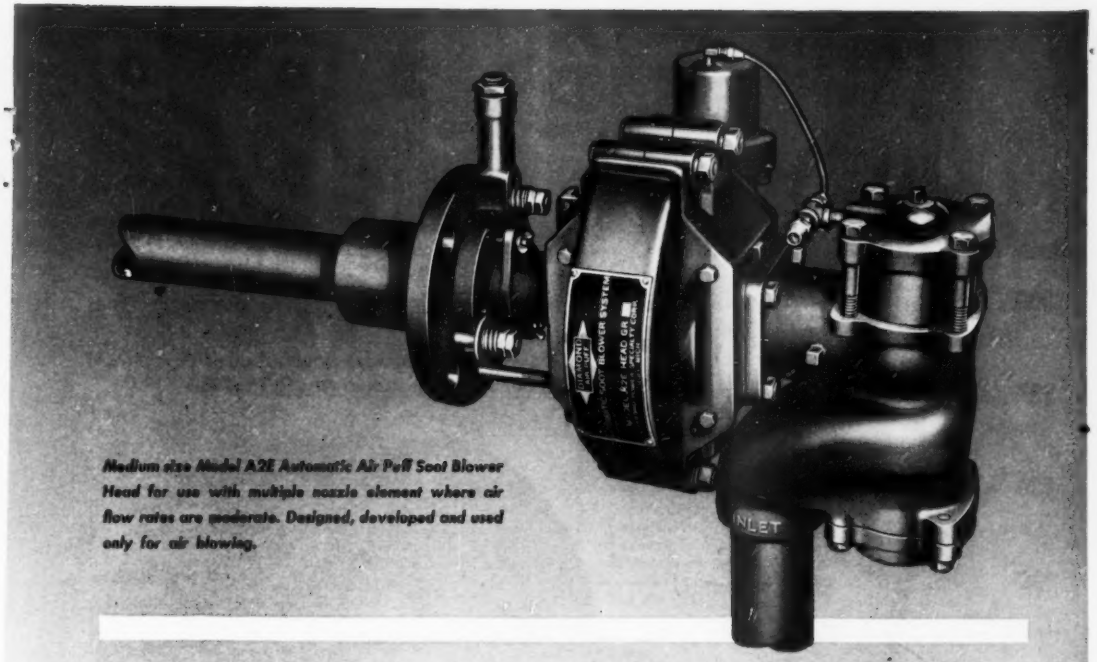
These *"air heads for air blowing"* are typical of the Diamond policy of always developing and providing the correct equipment for the individual job . . . a policy that means better boiler cleaning and lower operating costs to the customer.

WRITE FOR CATALOG NO. 1014

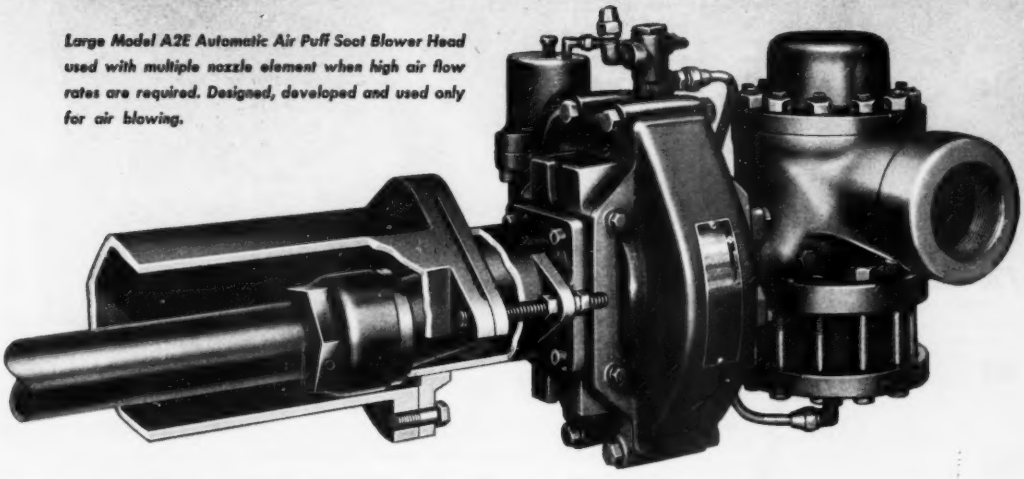
It illustrates and describes the wide variety of Diamond Soot Blowers . . . it discusses where each is used for correct cleaning and operating economy.

DIAMOND

3712



Medium size Model A2E Automatic Air Puff Soot Blower Head for use with multiple nozzle element where air flow rates are moderate. Designed, developed and used only for air blowing.



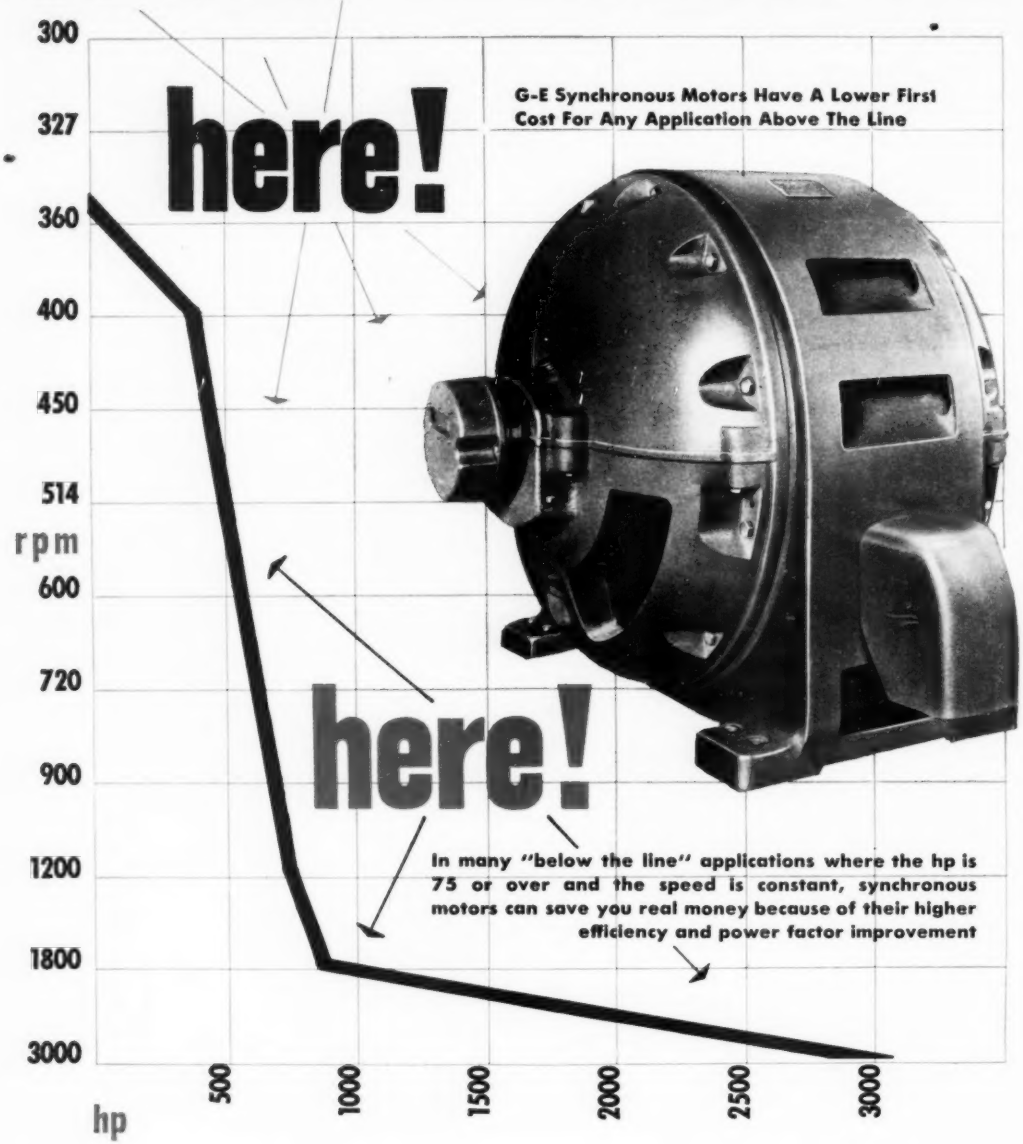
Large Model A2E Automatic Air Puff Soot Blower Head used with multiple nozzle element when high air flow rates are required. Designed, developed and used only for air blowing.

Power Specialty Corp.

DETROIT 31, MICHIGAN

DIAMOND SPECIALTY LIMITED • Windsor, Ontario

SAVE MONEY!


300
327
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2000
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3000
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G-E Synchronous Motors Have A Lower First Cost For Any Application Above The Line
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In many "below the line" applications where the hp is 75 or over and the speed is constant, synchronous motors can save you real money because of their higher efficiency and power factor improvement

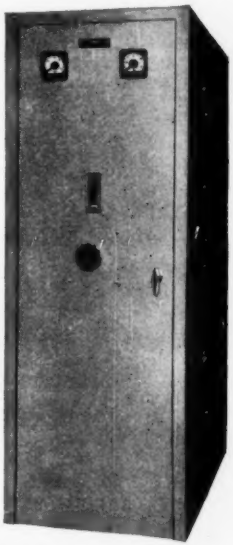
USE GENERAL ELECTRIC SYNCHRONOUS MOTORS

In their natural fields of application, synchronous motors have a *lower first cost* than any other kind of motor!

When you specify General Electric synchronous motors, you get unequalled application engineering by experts in the electrical problems of your industry. They make sure you get the right motor —the motor that will give you the greatest return on your investment.

For your next large, constant speed motor, ask your General Electric sales representative for the full story, and how you can take full advantage of the money saving features of G-E synchronous motors.

GET THE MOST FROM YOUR MOTOR WITH G-E CONTROL



New rotor field circuit prolongs life of your motor and equipment. Offers: precise synchronization (within half a cycle); constant protection without "babying" the motor; automatic and instant field removal at slip cycle.

This factory assembled and tested unit is your assurance of accurate motor performance regardless of type of G-E synchronous motor control you require — full-voltage magnetic, reduced-voltage magnetic, or reduced-voltage semi-magnetic. Standard, heavy duty components are panel mounted, enclosed in a compact, steel cabinet. Short-circuit protection with air-circuit breakers or high-voltage fuses is available. All parts easily accessible, little maintenance required, adjustments easy.

This is the quality control your synchronous motor needs for really efficient operation. It is specially engineered and built for years of service for your application. Write for the bulletin in the coupon.

Apparatus Dept., Sec. E770-4, General Electric Company
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Gentlemen:
I would like more information on the advantages of synchronous motors. Please send me the indicated descriptive literature.

☐ GEA-529D ☐ GEA-5113 ☐ GEC-505

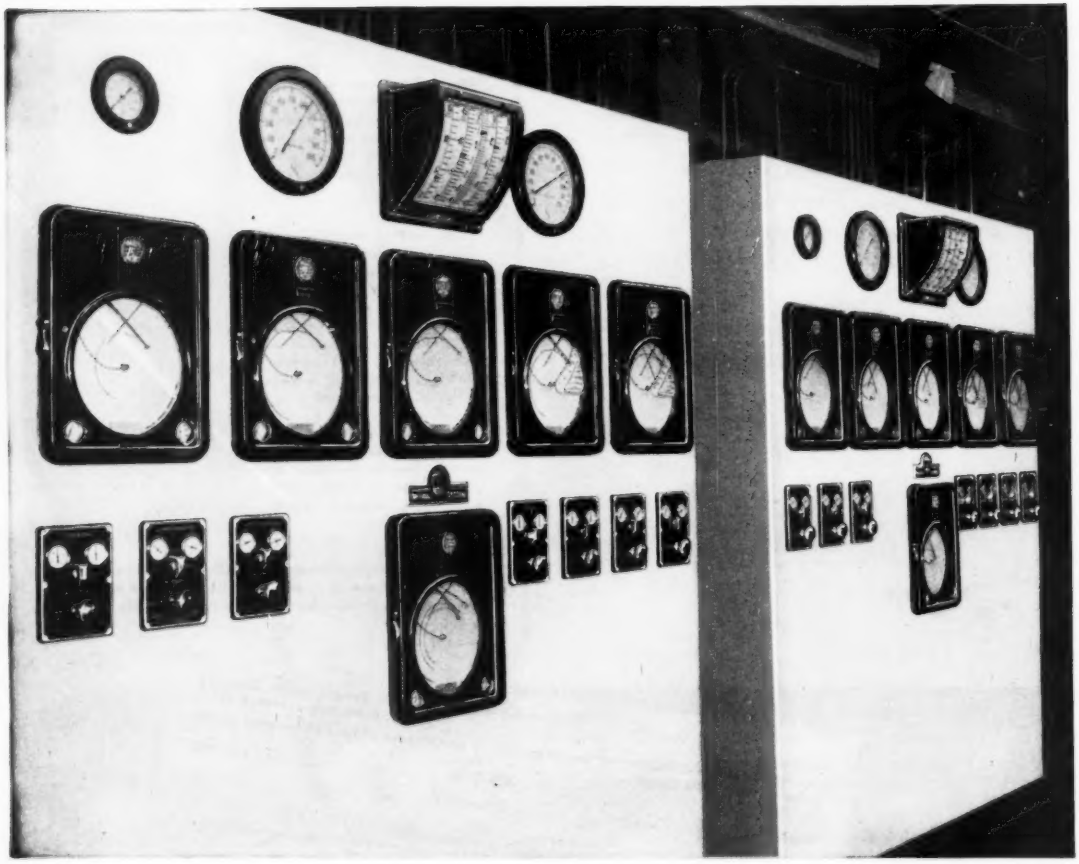
Name.....Company.....

Street.....City.....

State.....

GENERAL ELECTRIC

some Btu's are always



Btu's receive no vacations from this co-ordinated Bailey boiler control system on a 135,000 lb. per hr. capacity gas and oil-fired boiler. Controls for combustion, feed water, steam temperature and flue gas temperature are included on this panel.

Branches in: Boston, New York, Schenectady, Philadelphia, Buffalo, Pittsburgh, Charlotte, Cleveland, Detroit, Cincinnati, Atlanta,

on vacation

Yes, some Btu's are always on vacation. Your problem is to prevent too many from getting the habit. Loafing Btu's produce no power. You have to make them work. Then you get low power costs. And that is what you get when you install the Bailey co-ordinated boiler control system.

The Bailey system reduces fuel consumption per pound of steam generated. Combustion, feed water, steam temperature, heater levels, pump speeds and other factors are co-ordinated. Safety of operation is increased—continuity of service is improved. You convert the maximum number of Btu's into power and get all the efficiency your boiler was designed to deliver.

One thing to remember. The Bailey system is not delivered as a standard package. Each one is designed and engineered to the specific job on which it is to be used. That's why it functions so efficiently.

If you are looking for low cost power, it will pay you to call our nearest office.

A-106-2

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BAILEY METER COMPANY LIMITED, MONTREAL, CANADA

Controls for Steam Plants

COMBUSTION • FEED WATER • TEMPERATURE
PRESSURE • LIQUID LEVEL • FEED PUMPS

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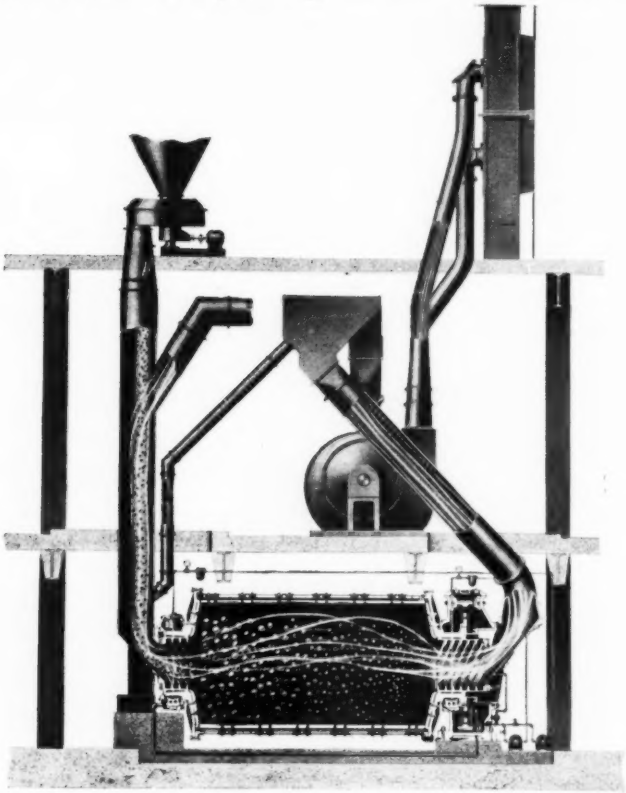
KVS PULVERIZING EQUIPMENT

provides completely carbureted fuel–



THE KVS Air Swept Tube Mill floats out an impalpable powder to the burners, so completely combustible that cold units can be safely lighted off with the simplest torch. Unburned carbon in the furnace is less than ½%.

Surface moisture is removed from the coal in the pulverizer. The KVS heavy-duty exhauster draws preheated air through the mill inlet, drying each particle of coal during passage through the mill. The air stream picks up the finely pulverized coal and, after separating any large particles in the classifier, delivers an ideal mixture of oxygen and carbon to the burners.

Magnetic separators are not used with the Kennedy System. Tramp iron assists in pulverizing coal.

Additional grinding balls, when required, are entered in the mill inlet with the raw coal. Kennedy Air Swept Pulverizers never require ball classification. Mill availability is over 99%.

Any coal—in quantities to 35 tons per hour per mill—can be prepared as a superfine fuel, with complete control of firing rate assured, by providing your power plant with KVS pulverizing and firing equipment.

Ask for a copy of 97-page Engineering Bulletin No. 44-B, containing valuable information on preparation of pulverized fuel and steam generating plants.

KVS ENGINEERING SERVICE

KVS offers a complete service in design, building and erecting complete steam generating plants under one responsibility. KVS engineers are available for consultation on your requirements.

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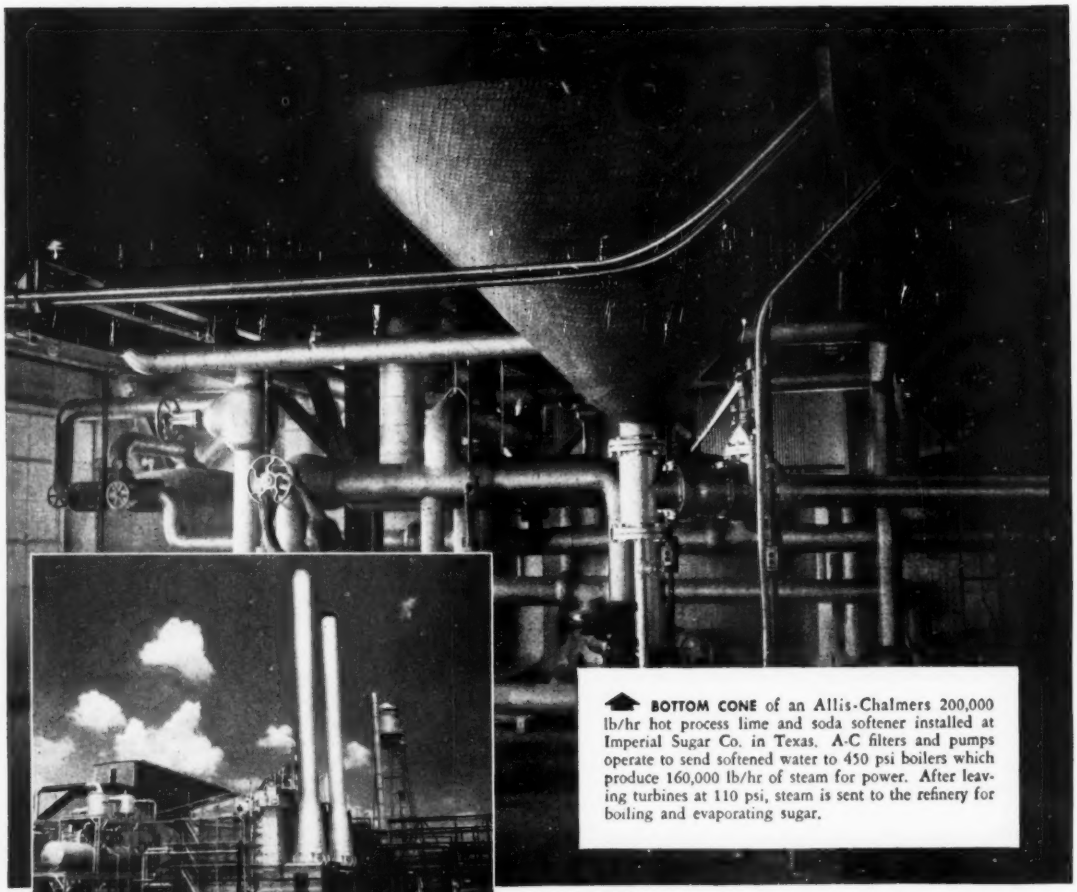
3-way program water treatment



BOTTOM CONE of an Allis-Chalmers 200,000 lb/hr hot process lime and soda softener installed at Imperial Sugar Co. in Texas. A-C filters and pumps operate to send softened water to 450 psi boilers which produce 160,000 lb/hr of steam for power. After leaving turbines at 110 psi, steam is sent to the refinery for boiling and evaporating sugar.

CLEAN STEAM for sugar processing leaves the new power plant for the Southwest's leading sugar refinery, helping to produce 1,600,000 lb of refined sugar per day.

ALLIS-
Water Conditioning

(SERVICE • CHEMICALS • EQUIPMENT) *at Work in Industry*

helps you solve problems!

WHAT ALLIS-CHALMERS *SERVICE-CHEMICALS-EQUIPMENT* DOES FOR THESE FOOD PLANTS—IT CAN DO FOR ANY INDUSTRY THAT NEEDS COMPETENT TIME AND MONEY SAVING AID!

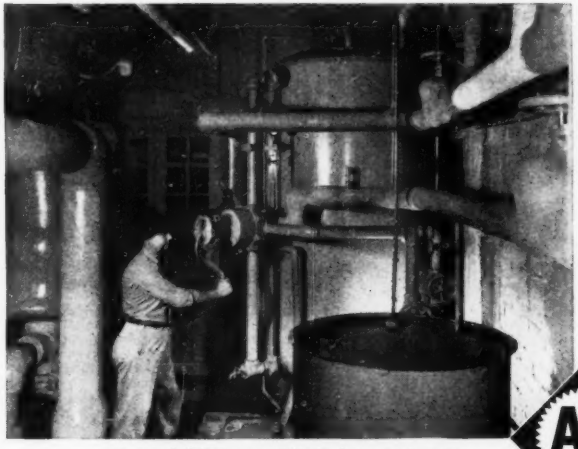
PLANT MEN IN FOOD-PRODUCING industries like sugar refining and dairying, for example, know the need for action when water treating problems arise. They know, too, that to work with a competent water conditioning organization means a savings in time and effort for all concerned.

For *all* industries, Allis-Chalmers in the water conditioning field not only provides a first hand study of water treating needs, but works right along with customer engineers in selecting the right process and correct equipment.

ALLIS-CHALMERS SERVICE starts with a complete study of water supplies and impurities, surveys of present methods and plant operating conditions. Following this: recommendations, selection of chemicals, periodic reports, and service calls.

CHEMICALS comprise a complete new line of formulations for scale and corrosion control in all types of cooling towers and heat exchangers. Also reliable AKON and SILIMITE which effectively prevent boiler scale and corrosion . . . reduce silica.

EQUIPMENT includes hot and cold process softeners, sodium and hydrogen zeolite softeners, degasifiers, deionizers, chemical proportioners, and oil removal and water filters.



SODIUM ZEOLITE softener at Pabst Farms Dairy in Wisconsin is a 9,000 gal unit treating extremely hard well water for steam-pasteurizing and evaporating fresh milk.

Akon and *Silimite* are Allis-Chalmers trademarks

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Please send me:

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- ☐ 6611 Description of Hot Process Water Softeners
- ☐ 7107 Sodium Zeolite Softeners

Name.....

Company.....

Title.....

City.....

State.....

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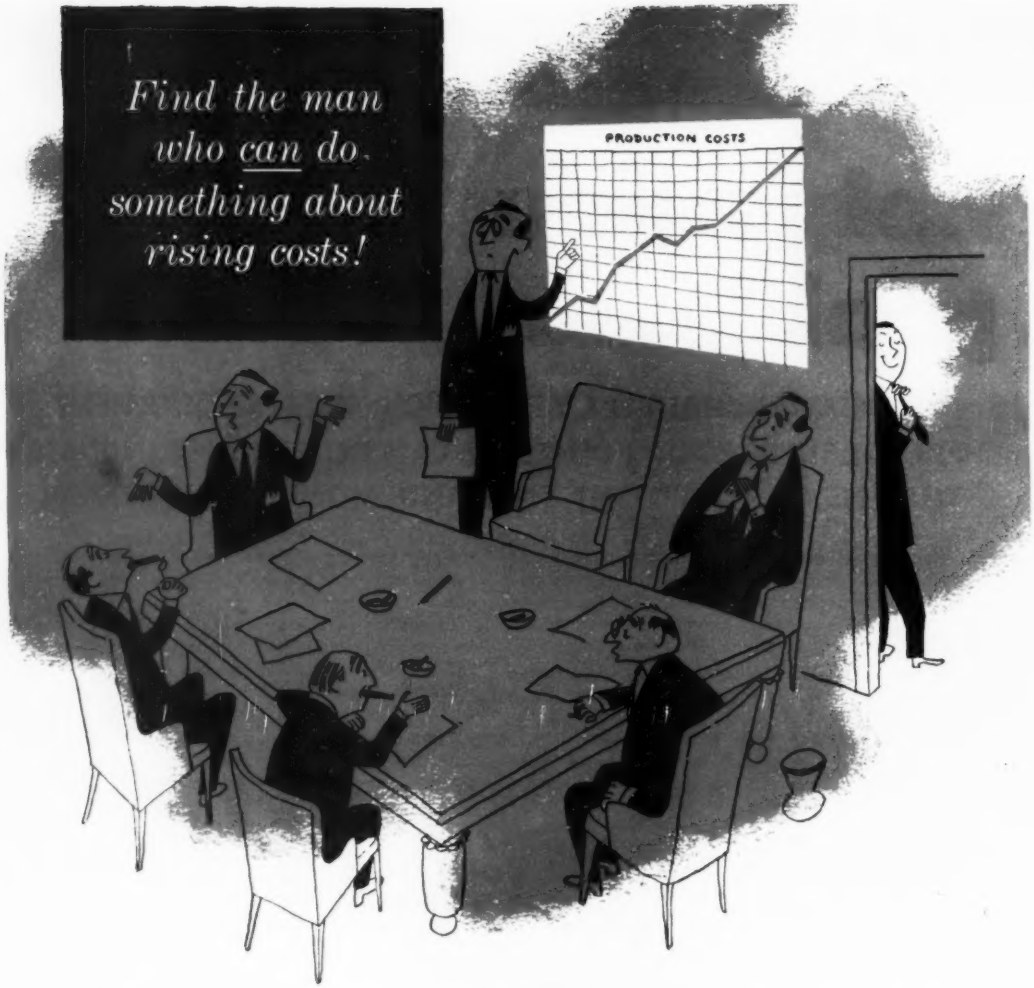

In most businesses, operating costs are still on the rise. But there's *one* man who *can* do something about it—he's the man whose job is to get maximum heat and power from fuel dollars. He knows you *get* maximum efficiency from Eagle-Picher Industrial Insulations because they're made of durable, chemically and physically stable *mineral wool*, noted for its low conductivity. They give long years of service and are easy to maintain and replace.

There's an Eagle-Picher insulation that can help reduce *your* operating expenses!

Let these Eagle-Picher products also save you money . . . power . . . time

Insulating Felts
Supertemp Block • Blankets
Loose Wool • Pipe Covering
Stalastic • Insulseal • Insulstic
Swetchek • Finishing Cements
Insulating Cements

THE EAGLE-PICHER COMPANY

General Offices: Cincinnati (1), Ohio

Insulation products of efficient mineral wool—for a full range of high and low temperatures. Technical data on request.

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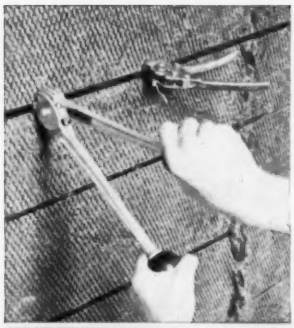
Since 1843

The perfect answer

FOR MAXIMUM FUEL SAVINGS AND EXACT TEMPERATURE CONTROL

For a completely effective, low-cost insulation combination, you can't beat the teamwork of Eagle-Picher Mineral Wool Blankets, Supertemp Blocks, Super "66" Cement and Insulseal. They work effectively to give your equipment higher efficiency . . . cut operating costs . . . and help to provide perfect, precise control over temperatures.



EAGLE-PICHER MINERAL WOOL BLANKETS

These blankets satisfy the need for a convenient method of quickly and efficiently insulating flat or curved surfaces on larger types of heated equipment. Mineral wool is felted and secured between flexible metal fabric. Outstanding physical and chemical stability enable Eagle-Picher Blankets to resist water, steam, corrosive fumes and normal vibration.

EAGLE-PICHER SUPERTEMP BLOCKS

Eagle-Picher Supertemp Blocks are lightweight (approximately 16 lbs. per cu. ft.). Can be cut easily with knife or saw to fit off-shaped areas . . . they fit snugly over minor irregularities. They're strong and have high refractory value. Withstand temperatures up to 1700 F. Conductivity at 512 F. approximately 0.43...all standard sizes, from 3" x 18" to 12" x 36" . . . in thicknesses from 1" to 4".

EAGLE-PICHER SUPER "66" INSULATING CEMENT

Super "66" is all-purpose, rust-inhibitive, extremely adhesive insulating cement. "Springy ball" pellets don't collapse after application . . . give great coverage, retain their thermal efficiency. 100 lbs. covers 65 sq. ft. —1 inch thick! Easily applied with trowel, over flat and irregular surfaces. Efficient for temperatures up to 1800 F. Reclaimable when used on equipment whose temperatures go up to 1200 F.!

EAGLE-PICHER INSULSEAL

A tough, weatherproof, protective coating for insulation. For temperatures up to 450 F. Applied as a plastic, its smooth troweling qualities assure uniform coverage, proper thickness. It protects insulation from air infiltration, fumes, rain, snow, vibration, punctures, and withstands severe service, indoors or out. Dries to a smooth, rich black, has a neat appearance on hot or cold surfaces . . . may be washed or painted.

THE EAGLE-PICHER COMPANY *General Offices:* Cincinnati (1), Ohio

Insulation products of efficient mineral wool—for a full range of high and low temperatures. Technical data on request.

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Since 1843

WHY MORE AND MORE PLANTS ARE CHOOSING SPREADER STOKERS

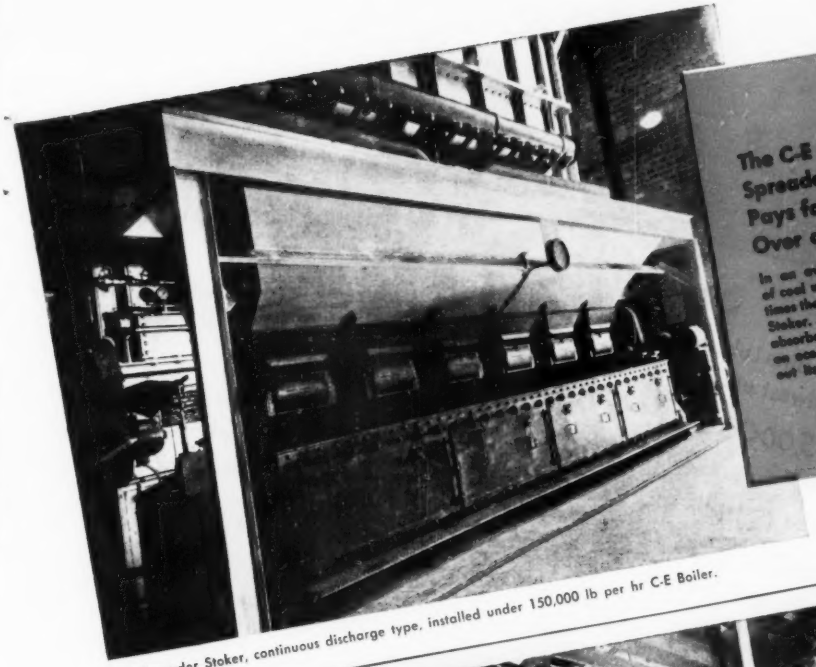
The current high price of coal places increased emphasis on the selection of a stoker that can burn a wide variety of coals efficiently . . . even the cheaper or lower grades. The spreader stoker is particularly well suited to meet these conditions. High ash, high volatile, eastern or mid-western bituminous, sub-bituminous, lignites — all are burned satisfactorily and efficiently by spreader firing. Coals with a high percentage of fines are no problem, for fines are burned in suspension and the larger particles on the grate. Thus, with the spreader stoker you are no longer limited to selected, premium-price coal and may take full advantage of the coals most economically available in your area.

C-E Spreader Stokers, available in both continuous discharge and dumping grate types, offer proven design features that make them outstanding values in their respective fields. And in addition, the users of the C-E Spreader Stoker gain the benefit of Combustion's vast knowledge of the proper application of fuel burning equipment — the accumulation of over 60 years experience in the design, manufacture and installation of more than 20,000 stokers under boilers of all types and sizes.

Moreover, since the C-E line includes every established type of stoker, Combustion is able to offer you impartial advice on the suitability of the spreader stoker for your plant. B-325

COMBUSTION ENGINEERING

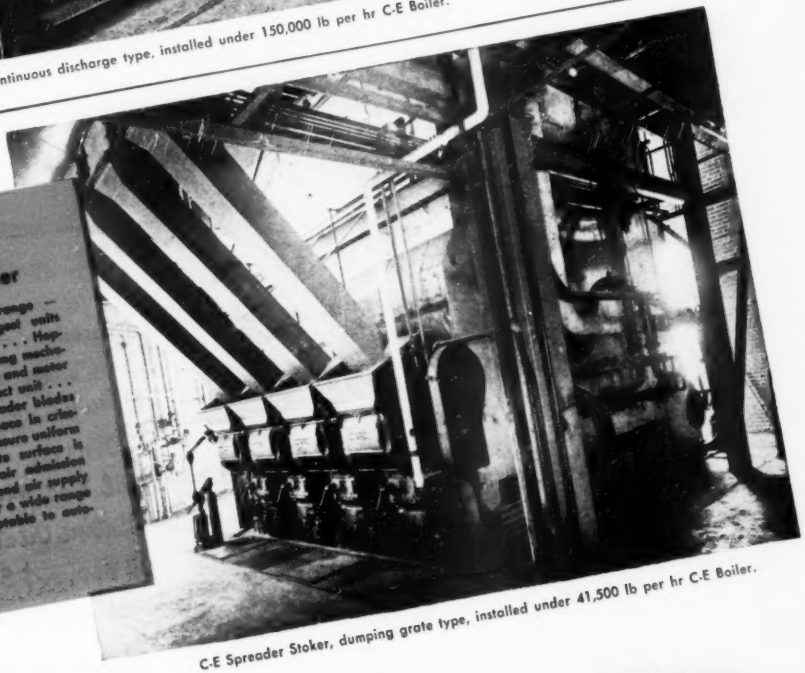
A MERGER OF COMBUSTION ENGINEERING COMPANY, INC. AND THE SUPERHEATER COMPANY



The C-E Spreader Stoker Pays for Itself Over and Over

In an average installation the cost of coal used in a year exceeds many times the initial cost of a C-E Spreader Stoker. Moreover, its first cost is soon absorbed by its saving in coal cost—an economy cycle repeated throughout its many useful years of life.

C-E Spreader Stoker, continuous discharge type, installed under 150,000 lb per hr C-E Boiler.



Features of the C-E Spreader Stoker

Approximate application range — from 150 hp to the largest units adaptable to stoker firing . . . Hopper, feeding and distributing mechanism, variable-speed drive and motor are combined in a compact unit . . . A series of rotating spreader blades feeds coal into the furnace in criss-crossing streams which assure uniform distribution . . . Grate surface is zoned for regulating air admission . . . Rate of fuel feed and air supply may be regulated over a wide range and are readily adaptable to automatic control.

C-E Spreader Stoker, dumping grate type, installed under 41,500 lb per hr C-E Boiler.

—SUPERHEATER, INC.

200 MADISON AVENUE, NEW YORK 16, N. Y.

C-E

Turbine lubrication costs

CASE STUDY

Annual Savings in Turbine Lubricating Costs with Nonpareil Turbine Oil in a Midwest utility.

Turbine ..... 35,000 KW, 1800 RPM
Oil System Capacity .... 2800 gallons
Operation ... 1931 to 1937 on Turbine Oil X at 45¢ per gallon
Operation ... 1938 to 1948 on Nonpareil Turbine Oil at 87¢ per gallon
Annual Cost of Lubrication with Turbine Oil X ..... $ 911.57 *
Annual Cost of Lubrication with Nonpareil Turbine Oil ..... $ 284.13 *
Annual Saving 68.8%

CASE STUDY

Annual Savings in Turbine Lubricating Costs with Nonpareil Turbine Oil on a large utility turbine.

Turbine ..... 80,000 KW, 1800 RPM
Oil System Capacity .... 8,000 gallons
Operation ... Dec. 1935, to April 1942, on Turbine Oil Y at 39¢ per gallon
Operation ... May 1942 to Jan. 1948 on Nonpareil Turbine Oil at 88¢ per gallon
Annual Cost of Turbine Lubrication with Turbine Oil Y ..... $ 575.30 *
Annual Cost of Lubrication with Nonpareil Turbine Oil ..... $ 503.93 *
Annual Saving 12.4%

STANDARD OIL COMPANY (INDIANA)

CUT...up to 68%

NONPAREIL Turbine Oil

"Will outlast your turbine"

STUDIES have been made of typical utility company operations to determine how much the *price* of turbine oil affects the *cost* of turbine operation. Three such studies are summarized here. In each case, the price of the original fill of oil was 38% to 55% *less* than that for Nonpareil. But in each case the total annual cost for lubrication, when all factors are considered, show a saving with Nonpareil.

You can find out how much Nonpareil will save on your lubricating costs. Standard Oil Lubrication Engineers have facts and figures to help you determine what would be your costs with Nonpareil for comparison with your present costs.

Write Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois, to secure the services of the Engineer nearest you.

CASE STUDY

Annual Savings in Turbine Lubricating Costs with Nonpareil Turbine Oil in a Midwest utility system.

Turbine ..... 20,000 KW (Now 30 years old)

Oil System Capacity .... 550 gallons

Operation ... June 1940, to Aug. 1944, on Turbine Oil Z at 55¢ per gallon

Operation ... Oct. 1944 to Oct. 1948 on Nonpareil Turbine Oil at 89½¢ per gallon

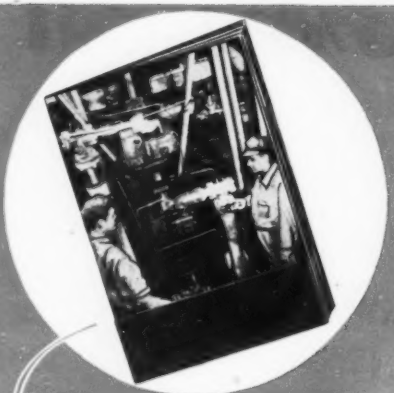
Annual Cost of Lubrication with Turbine Oil Z ..... $ 83.90

Annual Cost of Lubrication with Nonpareil Turbine Oil ..... $ 69.49 *

Annual Saving 17.2%

* Includes (1) cost of original fill, (2) oil replacements, (3) oil treating or sweetening, (4) cleaning turbine oil systems, (5) filter maintenance, where these items apply.

STANDARD OIL COMPANY (INDIANA) STANDARD



It's what the men

In this Midwest to say about

"BOON TO BOILER CLEANERS"

"Who said there was nothing new under the sun? Look at those soot blowers across the page. They have made boiler cleaning a cinch. Remember how the boiler cleaners once had to slave to free the tubes of slag? It's a push over now. Just push a button and let 'er go. They do a better job, a cleaner job and a more thorough job.

"The controlling machinery which rotates the lance, pushes it into the boiler, pulls it out again and the automatic valve for turning steam on and off at the proper time all are located outside the boiler. The simple motion of pressing a button starts the operation.

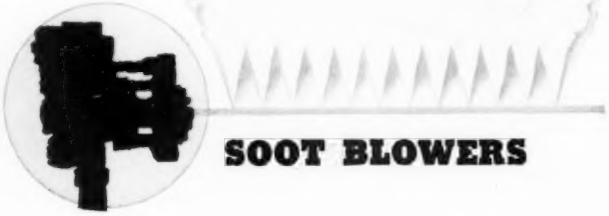
"On the lower tubes where the blowers use 350 pounds steam pressure, the retractables will rip off adhering slag which the old-fashioned blowers wouldn't touch. This slag had to be knocked off by hand, piece by piece, tube by tube, with a 24 foot water cooled (hand) lance. The new blowers complete in minutes what formerly took man hours.

"In the superheaters, these soot blowers keep the tubes cleaner than combined hand lancing and old-fashioned soot blowers could. The push button has eliminated hand lancing and the hard, hot labor required to turn the old soot blowers.

"Two previous installations (of old-fashioned soot blowers) on the reheater of 2-1 boiler were complete failures. The

VULCAN SOOT BLOWER CORPORATION • DUBOIS, PA.
DIVISION OF
CONTINENTAL FOUNDRY & MACHINE COMPANY

36 VULCAN T-2's are used on the 6 boilers at this large Mid-West Central Station. Vulcan T-2 Long Retractable Blower with revolving lance fully extended shown above. These blowers are built for travels up to 25 feet and are push button controlled at the unit as well as at the central control panel — Bulletin 474.

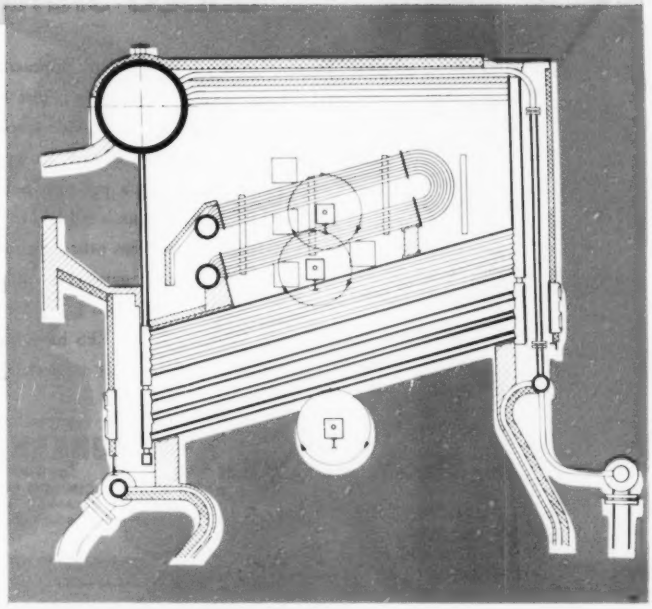


VULCAN
STEAM OR AIR
SOOT BLOWERS

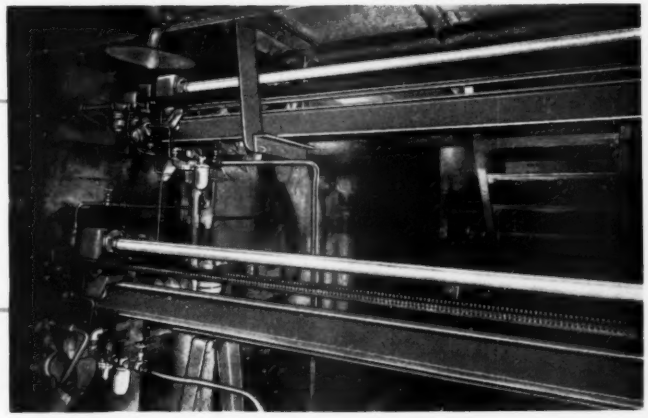
in the plant say ~ that counts

Utility magazine they have this VULCAN T-2 "Retracts"

reheater slowly plugged up with caked dust and had to be rodded out and washed during boiler outages. Now it can be kept clean indefinitely thereby eliminating boiler outages and the hard work of rodding and washing. The old soot blowers required hand opening of 26 separate valves. The retractables are operated by pushing 7 buttons. "Yes, things are certainly looking rosy for the boiler cleaners." "



Each of the 6 B & W 400,000 pounds-per-hour boilers at this large Mid-West Central Station is equipped with 6 Vulcan T-2 Long Retractable Soot Blowers.



View shows 2 Vulcan T-2 Retractables "using 350 pounds steam pressure these retracts will rip off adhering slag which old fashioned blowers wouldn't touch."

Model* Power Plant

...in Chicago Boiler House of United States Tobacco Co.

STREAMLINED in outward appearance, the power plant of United States Tobacco Company in Chicago is just as modern inside. Each item of equipment was carefully selected to provide efficient, trouble-free steam generation.

The illustration shows one of the many uses of LUNKENHEIMER VALVES in this installation... a pressure reducing valve station in the boiler room. Here high pressure steam is reduced for process uses, steam heating, and to obtain 125 lb. steam for various other purposes. Numerous other LUNKENHEIMER bronze, iron and steel gate, globe and check valves are used in the plant.

This up-to-date installation is another of many throughout industry in which LUNKENHEIMER VALVES have been installed, meeting every requirement for long life and low-cost services.

ESTABLISHED 1862

THE LUNKENHEIMER CO.

"QUALITY"

CINCINNATI 14, OHIO, U. S. A.

NEW YORK 13 CHICAGO 6 BOSTON 10 PHILADELPHIA 24

EXPORT DEPT. 318-322 HUDSON ST., NEW YORK 13, N. Y.

* "Model" tobacco, one of United States Tobacco Co.'s popular brands.

ARCHITECTS AND ENGINEERS:
Schmidt, Garden & Erickson, Chicago

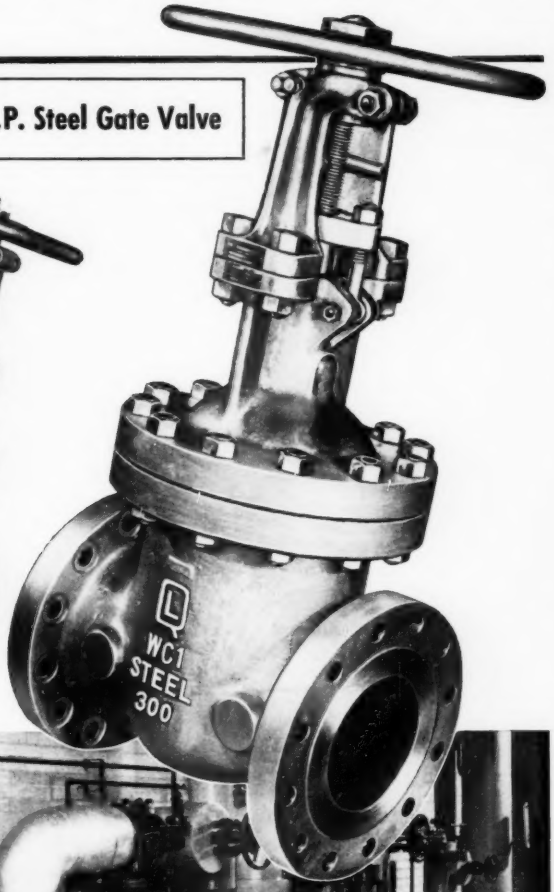
CONTRACTORS:
William A. Pope & Co., Inc.

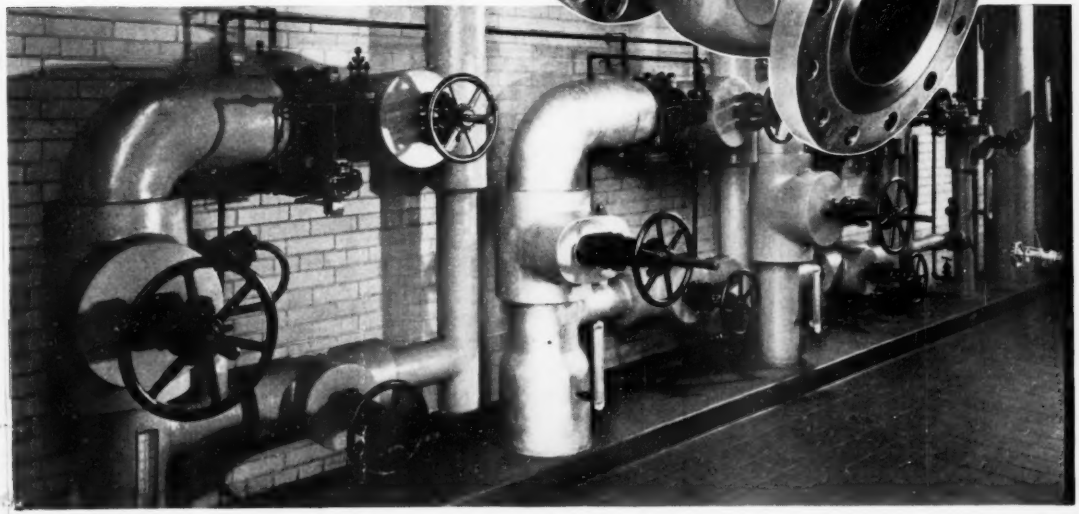
uses LUNKENHEIMER VALVES

300 lb. S.P. Steel Gate Valve

125 lb. S.P.
Iron Body Check Valve

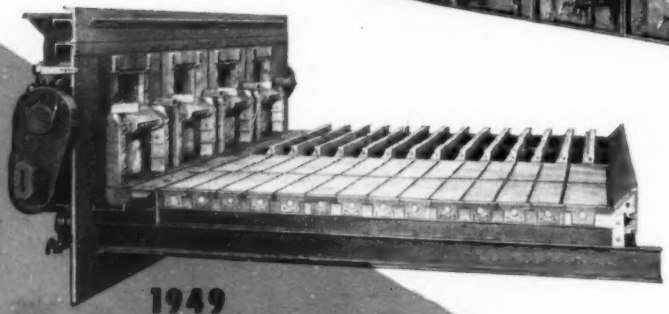
125 lb. S.P.
Iron Body Gate Valve





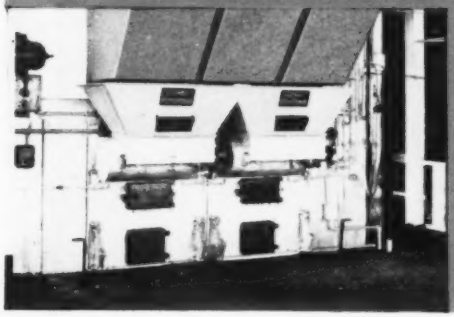
SAVING COAL IS OUR BUSINESS

Over 1700 Coal Saving—Cost Cutting Installations of Detroit RotoStokers Since 1931



1949

Power Dumping RotoStoker with four Rotors, driven by one 2 hp motor, with auxiliary turbine. A portion of the grate is shown in the dumped position. Built for Bibb Manufacturing Co., textile mill, Columbus, Georgia. Capacity, 60,000 pounds of steam per hour.



First RotoStoker Installed in 1931

This Hand Dumping RotoStoker in the Municipal Power Plant of Fort Morgan, Colorado, has been in service for 18 years—burning 9,000 B.T.U. Northern Colorado Lignite.

Our 51 Years in Stoker Manufacture Exclusively, including 20 Years of SPREADER Stoker Experience IS AT YOUR SERVICE

A pioneer in spreader stoker design and building, we have made applications of Roto-Stokers to all types and makes of boilers in a wide variety of plants both here and abroad.

STATIONARY GRATE—*The Stationary Grate RotoStoker is readily applied to small and medium boilers where no hand-ashed for ash handling is provided.*

A DOUBLE SAVING

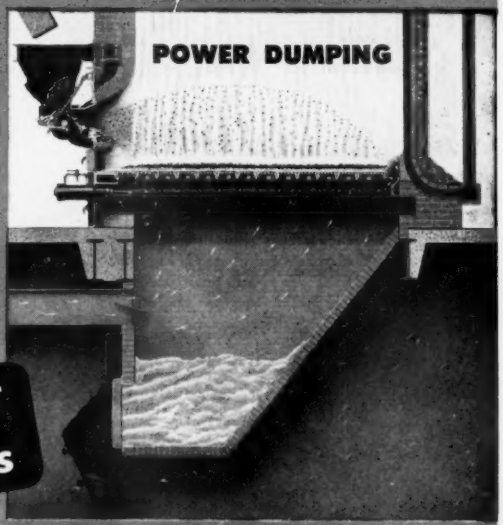
The RotoStoker provides a double saving: Saves first—by increased efficiency. Saves again—because it will burn any kind of Bituminous Coal or Lignite. Users, therefore, buy their coal at *best price advantage.*

RotoStoker burning rates are higher and will provide you with more capacity. The ability to handle fluctuating loads has made it popular.

The Detroit RotoStoker has distinct advantages over other methods of firing.

As stoker designers and builders of fuel burning equipment exclusively, we recommend in each case the method of firing best suited to your plant and the fuel available.

HAND DUMPING GRATE TYPE—With the *Hand Dumping RotoStoker, a shallow ash pit, as shown, is often sufficient. Ashes are discharged by releasing dumping levers and removed through the ash doors at the front when convenient.*



POWER DUMPING GRATE *—Steam Cylinders provide power for dumping. Each grate section is dumped independently of the others. Balance of the stoker carries the load with uniform steam pressure.*

OTHER TYPES AND SIZES OF DETROIT STOKERS FOR EVERY INDUSTRIAL NEED

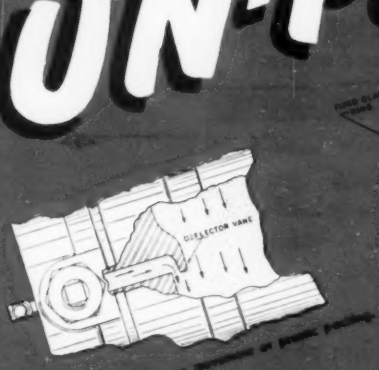
DETROIT SINCE 1898 STOKERS

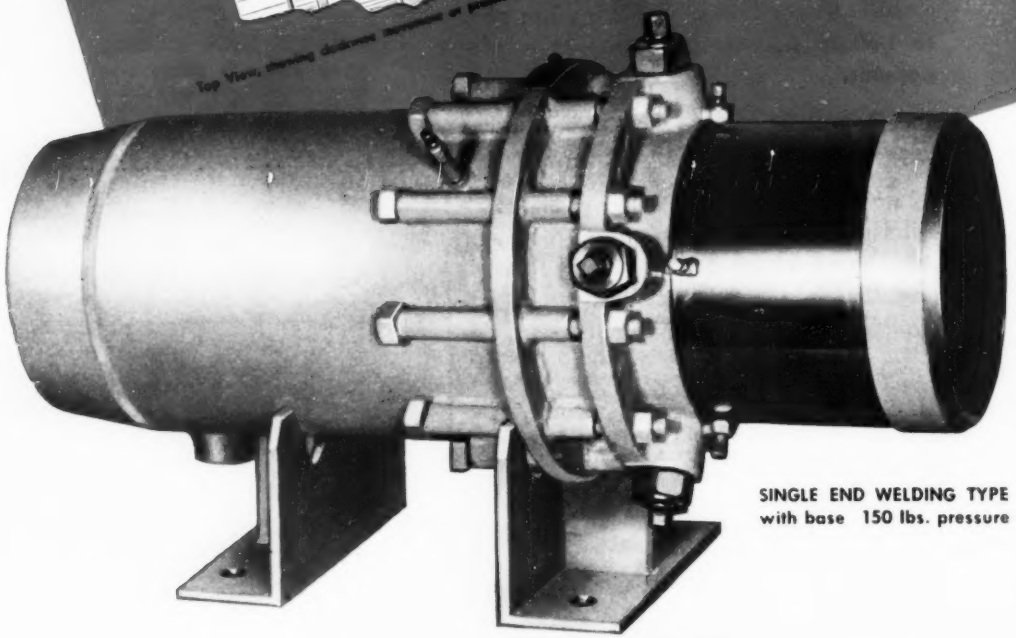
DETROIT STOKER COMPANY

GENERAL MOTORS BUILDING, DETROIT 2, MICHIGAN

Works at Monroe, Michigan: District Offices in Principal Cities

SAVE LABOR WITH GUN-PAKT





SINGLE END WELDING TYPE
with base 150 lbs. pressure

YARWAY

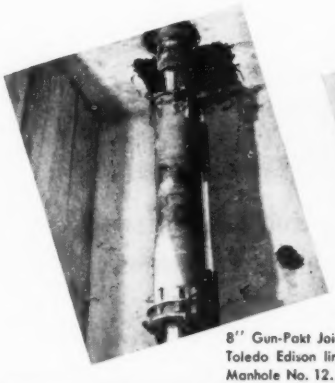
TOLEDO EDISON CHOOSES THE EXPANSION JOINT THAT IS *Serviced* UNDER FULL STEAM PRESSURE

Toledo Edison Company knows how to save on expansion joint maintenance. They use Yarway GUN-PAKT Joints—22 of them, ranging in size from 8″ to 14″ on their recent steam distribution extension.

GUN-PAKT Joints are serviced under full steam pressure . . . no costly shutdowns or heating interruptions. For repacking, simply insert a packing plug, twist a wrench, and the job's done! Special Alemite fittings provide for proper lubrication. Maintenance costs are low. One user says only 65 cents per year per joint. Others claim less than that. But wherever steam is distributed, and expansion joints are used, the trend is toward GUN-PAKT.

Read the GUN-PAKT story in Yarway's Bulletin EJ-1912. Write—

YARNALL-WARING COMPANY
100 Mermaid Ave., Philadelphia 18, Pa.



8″ Gun-Pakt Joint on Toledo Edison line at Manhole No. 12.

Yarway Gun-Pakt Joint on Toledo Edison Jackson Avenue line.

14″ Gun-Pakt Joint in Toledo Edison No. 1 Manhole.

BOILER CONTROLS • INSTRUMENTS • PROCESS CONTROLS

The Republic Flow Meters Co. offers a complete manufacturing and engineering service in the field of measurement and control. We will be glad to co-operate with you in the solution of any metering or control problem, whether it involves a single instrument or the automatic control of an entire process or plant.

Republic engineers, in co-operation with your own engineers, will be glad to study your problem and make recommendations as to the most practical solution. Your inquiries will involve no obligation on your part.

BOILER CONTROLS

For All Types of Boilers

Republic offers a centralized, automatic system for controlling steam pressure, combustion, furnace pressure, excess pressure, boiler water level, etc.

Automatically regulates the fuel and air imput to a boiler in measured proportions and in a fixed ratio for the entire load range. Available for all sizes of boilers and all types of fuel firing.

FLOW METERS

Electrical and Mechanical

Republic electrical type remote reading flow meters are available for measuring the flow of all types of liquids and gases. Meter bodies are built for line pressures up to 10,000 p. s. i. and for all ranges of differential pressures.

Mechanical ring-balance meters are built for static pressures up to 2500 p.s.i. and to operate on differentials as low as 3 in. of water.

BOILER METERS

Record Steam Flow—Air Flow

The Republic boiler meter records simultaneously on one chart the steam flow from the boiler and the rate of air flow to the furnace for combustion.

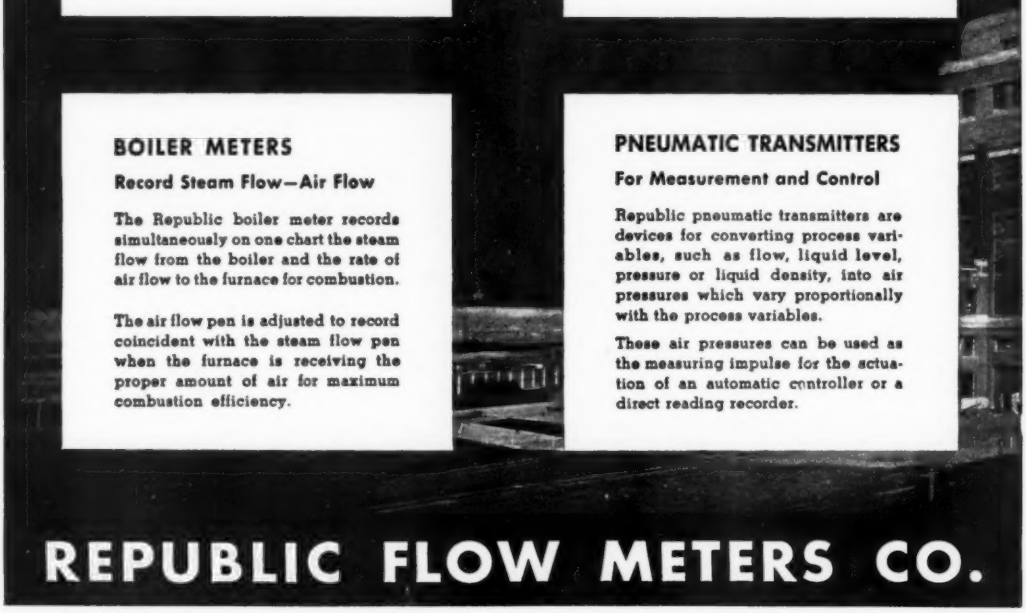
The air flow pen is adjusted to record coincident with the steam flow pen when the furnace is receiving the proper amount of air for maximum combustion efficiency.

PNEUMATIC TRANSMITTERS

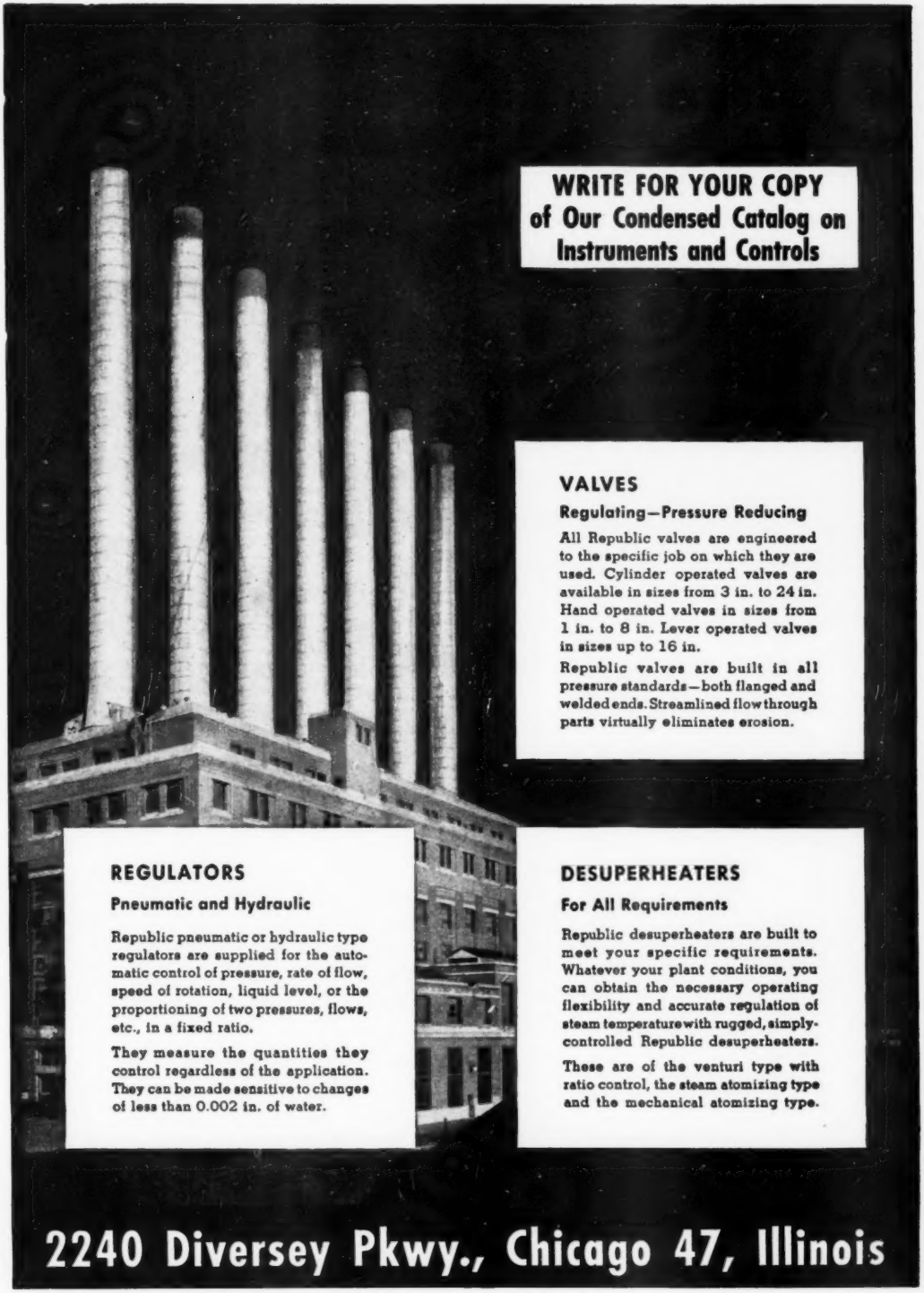
For Measurement and Control

Republic pneumatic transmitters are devices for converting process variables, such as flow, liquid level, pressure or liquid density, into air pressures which vary proportionally with the process variables.

These air pressures can be used as the measuring impulse for the actuation of an automatic controller or a direct reading recorder.



REPUBLIC FLOW METERS CO.



WRITE FOR YOUR COPY of Our Condensed Catalog on Instruments and Controls

VALVES

Regulating—Pressure Reducing

All Republic valves are engineered to the specific job on which they are used. Cylinder operated valves are available in sizes from 3 in. to 24 in. Hand operated valves in sizes from 1 in. to 8 in. Lever operated valves in sizes up to 16 in.

Republic valves are built in all pressure standards—both flanged and welded ends. Streamlined flow through parts virtually eliminates erosion.

REGULATORS

Pneumatic and Hydraulic

Republic pneumatic or hydraulic type regulators are supplied for the automatic control of pressure, rate of flow, speed of rotation, liquid level, or the proportioning of two pressures, flows, etc., in a fixed ratio.

They measure the quantities they control regardless of the application. They can be made sensitive to changes of less than 0.002 in. of water.

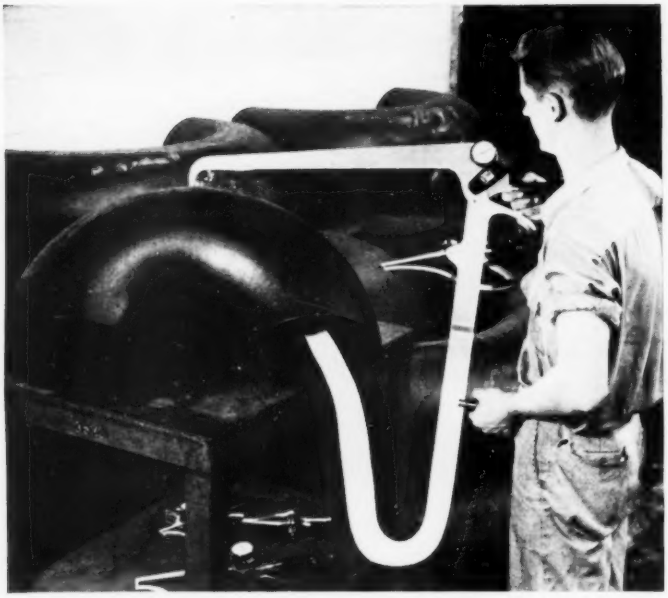
DESUPERHEATERS

For All Requirements

Republic desuperheaters are built to meet your specific requirements. Whatever your plant conditions, you can obtain the necessary operating flexibility and accurate regulation of steam temperature with rugged, simply-controlled Republic desuperheaters.

These are of the venturi type with ratio control, the steam atomizing type and the mechanical atomizing type.

2240 Diversey Pkwy., Chicago 47, Illinois



Precision through Care in Tube-Turn welding fittings

"Mike" checks 'em all!

THE wall thickness of Tube-Turn welding fittings simply has to be right. Every single Tube-Turn welding fitting is micrometer-checked before being put on the market.

Instruments of exclusive design do the trick. They measure wall thickness at the center of an elbow or 180° return as easily, accurately as at any other point. Whether it's ten, a hundred, or a thousand, the Tube-Turn welding fittings you buy are properly matched to pipe of corresponding size —at the face and throughout the fitting. Cut a Tube-Turn welding elbow to any odd angle required. It still lines up.

This micrometer check for dimensional accuracy is a small part of the thorough scrutiny to which the finished Tube-Turn product is subjected.

More than thirty skilled inspectors check for true circularity, accurate center-to-face dimensions, uniformity of curvatures, soundness of outside and inside surfaces, wall thickness of butt ends, bevels, lands, and quality of machining.

And that's just a fraction of the total *care* involved in the manufacture of Tube-Turn welding fittings.

Perfection begins with the raw material which is checked for conformity to required chemical composition and physical properties. It must pass all pre-determined requirements before acceptance for production of Tube-Turn welding fittings. Special materials, of course, undergo special tests.

When you buy "Tube-Turn" you want good connections. That's what you get, every time.

TUBE TURNS, INC.

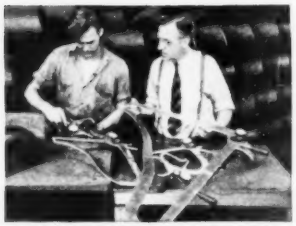
236 East Broadway, Dept. I, Louisville 1, Kentucky

District Offices at New York, Philadelphia, Pittsburgh, Chicago, Houston, Tulsa, San Francisco, Los Angeles

TUBE-TURN

tt

WELDING FITTINGS AND FLANGES



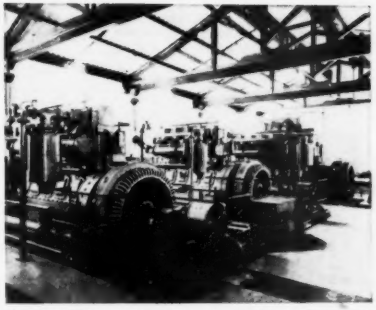
Five different-size gauges of exclusive design are used to check the wall thickness of every Tube-Turn welding fitting.

While one inspector checks the diameter of a 90° elbow, the other checks on perfection of inner wall.

Inspectors check the center-to-face dimension of a 20"-90° Tube-Turn welding elbow.

A part of the final inspection department. Here, Tube-Turn welding fittings undergo intensive instrumental and visual inspection.

How Brasil Oiticica and Worthington Solved a Vital Power Problem



Two Worthington CC-5 Diesels and one CC-8 Diesel at Brasil Oiticica, Fortaleza, Ceara.

When imports of tung oils from the Orient stopped during the war, a critical condition arose in the manufacture of paints and varnishes.

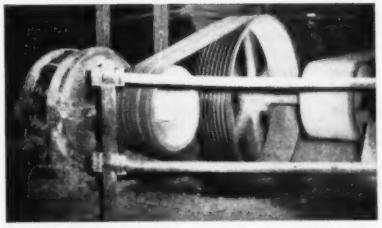
In the early 1930's, the Brasil Oiticica Company had begun to develop a substitute for tung oils known as oiticica oil. Oiticica oil is obtained from nuts of forest trees in northern Brazil. It was economically desirable to treat the crude oil at the source of supply, which created the problem of establishing and maintaining an efficient power plant. A reliable source of power was needed to prevent the disastrous solidifying of the oil in pipes and machinery, which occurs after power failure.

To avoid the consequences of the power failure, Brasil Oiticica Co. engaged Worthington do Brasil to install a Diesel power plant, placing an order for three Diesel engines and three generators. Mr. M. E. Marvin, president of Brasil Oiticica Co., selected Worthington to do the job because he believed that Worthington equipment would meet his rigid requirements for continuous operation.

In building the power plant another problem arose, because the Brasil Oiticica factory is located near the Atlantic Ocean where the water level is very close to the solid ground. The load-bearing quality of the soil is low in this area, and it was necessary to construct a special foundation to support the entire Diesel station. This foundation, designed by Worthington, consists of a large concrete mat in which there is space for four Diesel generators. The cranes and other construction materials which Brasil Oiticica Co. had ordered, were shipped in advance of the main equipment to facilitate the early finishing of the foundations and the construction of the power plant. When the machinery and generators were shipped, Worthington do Brasil supplied a field superintendent to supervise the installation and to instruct plant personnel in the correct methods for operating the equipment.

The power plant was put into continuous operation on March 1, 1947 and has operated satisfactorily since that time. It had operated 15,823 hours and had generated 2,347,800 kwh as of August 1, 1948.

V-Belt Drive Dusts Off 20 Years



Worthington V-Belt Drive at W. G. Bush & Co.'s Nashville, Tennessee mill.

At the W. G. Bush & Co. brickyard in Nashville, Tenn.—one of the largest in the South—a Worthington Multi-V-Drive is used to power line shafting which runs the pug mill and the conveyors.

The pug mill works the clay; the conveyors move bricks from die to loaders.

Despite the obviously dusty conditions, this drive has been operating a full day every day for twenty years without a breakdown, and the original set of belts is still in good condition.

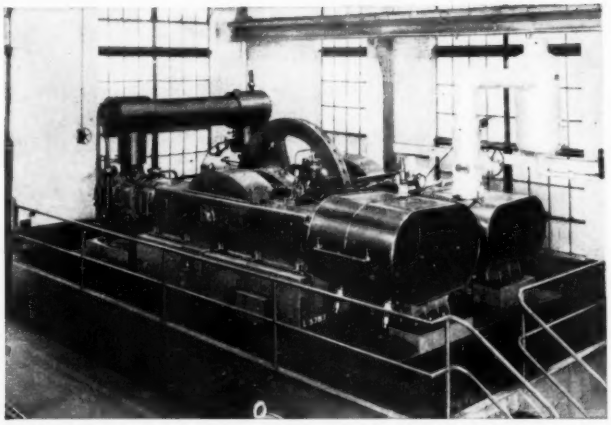
The belts are powered by a 125 hp motor, operating at 895 rpm, and run over sheaves of 24 in. and 60 in. PD.

NEWS

FROM THE POWER FRONT

AS REPORTED BY THE DEVELOPMENT ENGINEERS, FIELD SERVICE REPRESENTATIVES AND CUSTOMERS OF WORTHINGTON

No Hole in the Wall Needed to Get Air



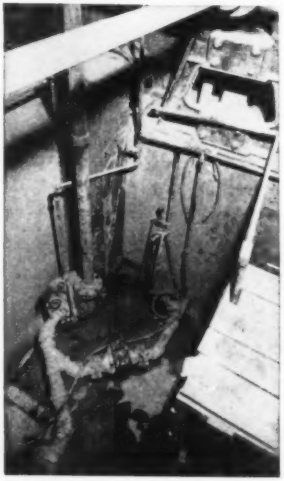
This is the type of Worthington air compressor used in the spark plug plant referred to in the story.

A large spark plug manufacturer likes compressed air because it is most suitable to the special nature of the operations in the plant, is a clean type of power, and keeps production at a top level.

The management selected Worthington air compressors because of their heavy-duty slow-speed characteristics, resulting in long life. These units are steam-driven. Preventive maintenance keeps them in top-notch shape.

The air compressors are located in a room which is so packed with air compressors that it would necessitate removing part of a brick wall if a piston rod had to be removed from a unit. But the performance of the Worthington machines has been such that no masonry work has ever been required.

And no work stoppage has ever been charged to lack of air.



Worthington 4-CF-1 pump at Buffalo Pottery, Inc., Buffalo, N. Y.

Mixing Multiplied By 4

Blunging, in a pottery, is the process of mixing various types of clay together in water. The quality of the china depends upon the quality of the mixture.

The conventional blunger is an oval-shaped pit in which propeller-type agitators are rotated while various proportions of clays are added to the mixture.

At Buffalo Pottery, Inc., manufacturers of a high-quality hotel and restaurant dinnerware, the blunging operation was falling behind the rates of production in other departments which had been modernized, and a speed-up was called for.

Loading and blunging a 6,000 lb batch took 2½ hours, using a 15-hp motor, and the final specific gravity was limited to 1.46 maximum. The average specific gravity of the clay added is 2.5. This results in a fairly thick mixture.

Installation of a Worthington 4-CF pump to replace the propeller-type mixers reduced the blunging time to 1¼ hours and made possible increasing the load to 8,000 lbs with a final specific gravity of 1.52, and at the same time decreased the power requirement to 8 hp.

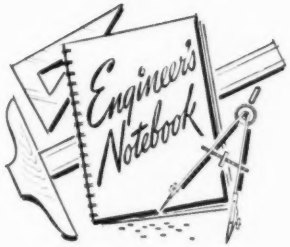
Installed in a pit next to the blunger, the pump serves as a circulator for the blunger and also to transfer the mix from the pit to storage prior to filtering.

There has been a decrease in the time required to load and unload, and also in the filter pressing operation, resulting in an overall production increase of approximately 400%. Furthermore, the quality of the slip has been tremendously improved.

City water is supplied to the seal cage in the stuffing box and the pump is protected from possible damage by tramp iron by the installation of a magnetic trap in the suction line. A suction strainer had been tried, but it was found that the slip was so thick that the strainer readily plugged. The success of the operation has been proved by a full year of service.

Worthington Pump and Machinery Corporation
Harrison, N. J.

NEWS



Steam Turbine Types and Applications

Steam turbines are divided into two types of drives: Generator-Drive Turbines, those used to drive A.C. or D.C. Generators; and Mechanical-Drive Turbines, those used for driving any piece of apparatus other than generators.

Basically, all turbines can be divided into two classes: Condensing, those that exhaust below atmospheric pressure; and Non-condensing, those that exhaust to a pressure equal to, or greater than, atmospheric pressure. A turbine, however, is a very versatile piece of machinery and many modifications can be made to these two basic designs in order to get the most economical installation.

For powers up to 500 kw or 750 hp, usually either of the two basic classes of turbines, that is, condensing or non-condensing, will prove economical. However, higher loads may warrant the consideration of one or the other of the two basic turbines with modifications such as: Automatic Extraction (Bleeder), Mixed Pressure, Mixed-Pressure Extraction, or Double Extraction.

These modifications of the basic classes are described as follows:

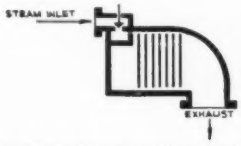
1. *Automatic Extraction Turbines* include a device (or devices, in case of Double Automatic Extraction) for controlling the pressure of the steam extracted (or bled) from the turbine by regulating the flow of steam to the turbine stages below the extraction opening.

2. *Mixed-Pressure Turbines* are provided with separate inlets for steam at two or more pressures and have one or more devices for controlling the secondary steam inducted into the turbine by regulating the flow of steam to the stages below the induction opening.

3. *Mixed-Pressure-Extraction Turbines* combine the features as described in 1 and 2 above.

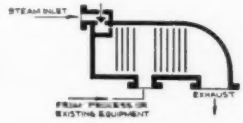
Schematic sketches with the most common uses of the various turbines are shown below.

P-13



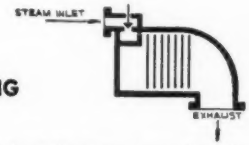
CONDENSING

Used when exhaust steam from the turbine cannot be utilized and power must be generated on a minimum amount of steam.



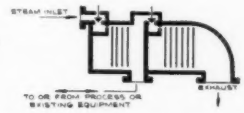
MIXED-PRESSURE

Used when there is excess steam available at lower-than-inlet pressure and when this supply is intermittent.



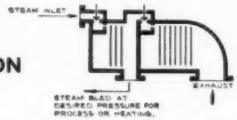
NON-CONDENSING

Used when all or practically all the exhaust steam from the turbine can be used for process or heating.



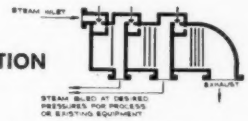
MIXED-PRESSURE-EXTRACTION

Used to supply process steam when necessary and to utilize a surplus of process steam when available



SINGLE EXTRACTION

Used when process steam requirements are variable or intermittent. (A non-condensing extraction turbine can be used when process steam is required at two different pressures.)

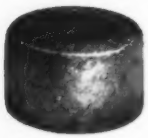


DOUBLE EXTRACTION

Used when process steam is required at two different pressures (or at three different pressures if non-condensing).

Toothed Lock Washer: Prevents loss of stem nut due to vibration, thereby holding the handwheel securely.

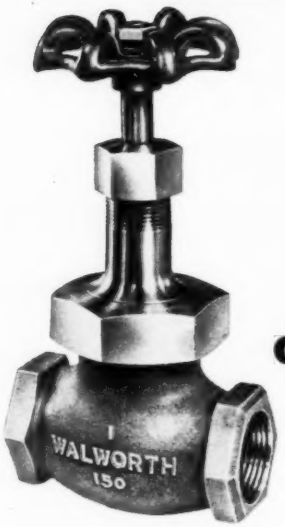
Newly Designed Handwheel: Air-cooled, finger grip handwheel affords sure grip even with greasy gloves.



Improved Packing: Molded packing of lubricated asbestos reinforced with copper wire. Suitable for practically every service. Valves can be repacked under pressure.

Hexagonal Union Bonnet Connection: Eliminates any chance of distortion or leakage even though valve is repeatedly taken apart and assembled.

WALWORTH



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No. 95
BRONZE
GLOBE VALVE

also available in Angle Type (No. 96)

The service ratings of the Walworth No. 95 are 150 pounds per square inch steam at 500F, and 300 pounds per square inch non-shock cold water, oil, and gas. In the manufacture of this quality bronze valve, more than 47 gages are used in machining parts to micrometric accuracy, thus insuring interchangeability of parts. For further information see your local Walworth distributor, or write: Walworth Company, 60 East 42nd St., New York 17, N. Y.

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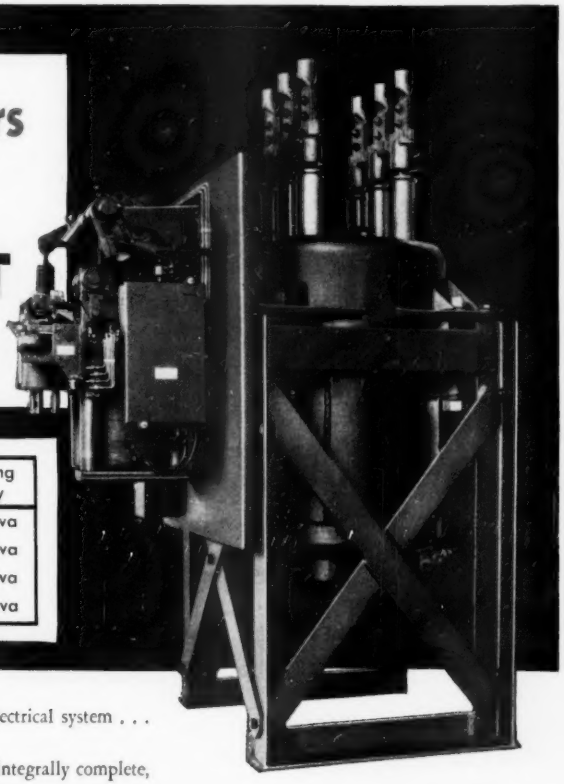
New Cylindrical Disc Holder: The design of the top portion of the disc holder keeps the disc accurately guided under all operating conditions.

Renewable Asbestos Disc: This disc is suitable for steam up to 500F and is resistant to oil, gasoline, and many chemicals at atmospheric temperatures. Discs for special services are available.

Extra Strong Body: Made of Composition M (ASTM B61) bronze thick enough to provide a high safety factor. Valves undergo hydrostatic shell test of 450 psi.

SAVE for DOLLARS for SPACE

with Allis-Chalmers Type DZ INDOOR OIL CIRCUIT BREAKERS



Type	Rated KV	Interrupting Capacity
DZ-40B	7.2	100,000 kva
DZ-60B	13.8	150,000 kva
DZ-100B	13.8	250,000 kva
DZ-200B	13.8	500,000 kva

HERE'S ECONOMICAL PROTECTION for your electrical system . . . with minimum space requirements.

"DZ" breakers are economical because they're integrally complete, with supporting framework, solenoid operator, control relay and auxiliaries — ready for installation. They can readily be used to replace existing breakers, in *existing cell structures*, where larger interrupting capacities are required.

They're space-saving, because they're compactly designed. Whether you're expanding or revising your present system . . . or installing a *new* system . . . remember that space requirements can be kept to a minimum with compact "DZ" protection.

Send coupon today for detailed information on Allis-Chalmers dollar-and-space-saving "DZ" oil circuit breakers. Or contact your nearby A-C sales representative.

GET DZ BREAKERS IN THESE MOUNTING ARRANGEMENTS

- ✓ **Cell Mounted**
- ✓ **Frame Mounted**
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Please send bulletins 7186129 and 7186179, giving specifications and dimensions of DZ Breakers.

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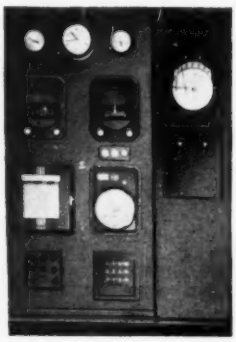
WATER CONDITIONING EXPERIENCE PROVES ITSELF

The fact that users of Cochrane water conditioning apparatus continue to come back to Cochrane for additional equipment when plants are expanded or new ones established is adequate proof of the consistently satisfactory operation of Cochrane softeners, deaerators, filters, etc.

Pittsburgh Plate Glass Company is one of Cochrane's old customers who have ordered and reordered Cochrane softeners year after year, some of these orders going back over thirty years.



The Cochrane Hot Process Softener installation at Pittsburgh's Columbia Chemical Plant at New Martinsville, W.Va., shown on these pages, was originally installed as a simple lime-soda softener to treat 40,000 GPH of Ohio River water having a calcium carbonate hardness of 40 ppm. The treated water is deaerated in the Cochrane Atomizing Deaerator section. The sedimentation tank also includes a separate tray type condensate deaerator having a capacity of 50,000 GPH.

Recently, because of the long retention time resulting from excess capacity, the softener has been used as a two-stage system by adding phosphate to the uptake funnel of the sedimentation tank.

Controls are located conveniently on a panel board where adjustment of chemicals may easily be made by means of the Cochrane electrically operated proportioner.

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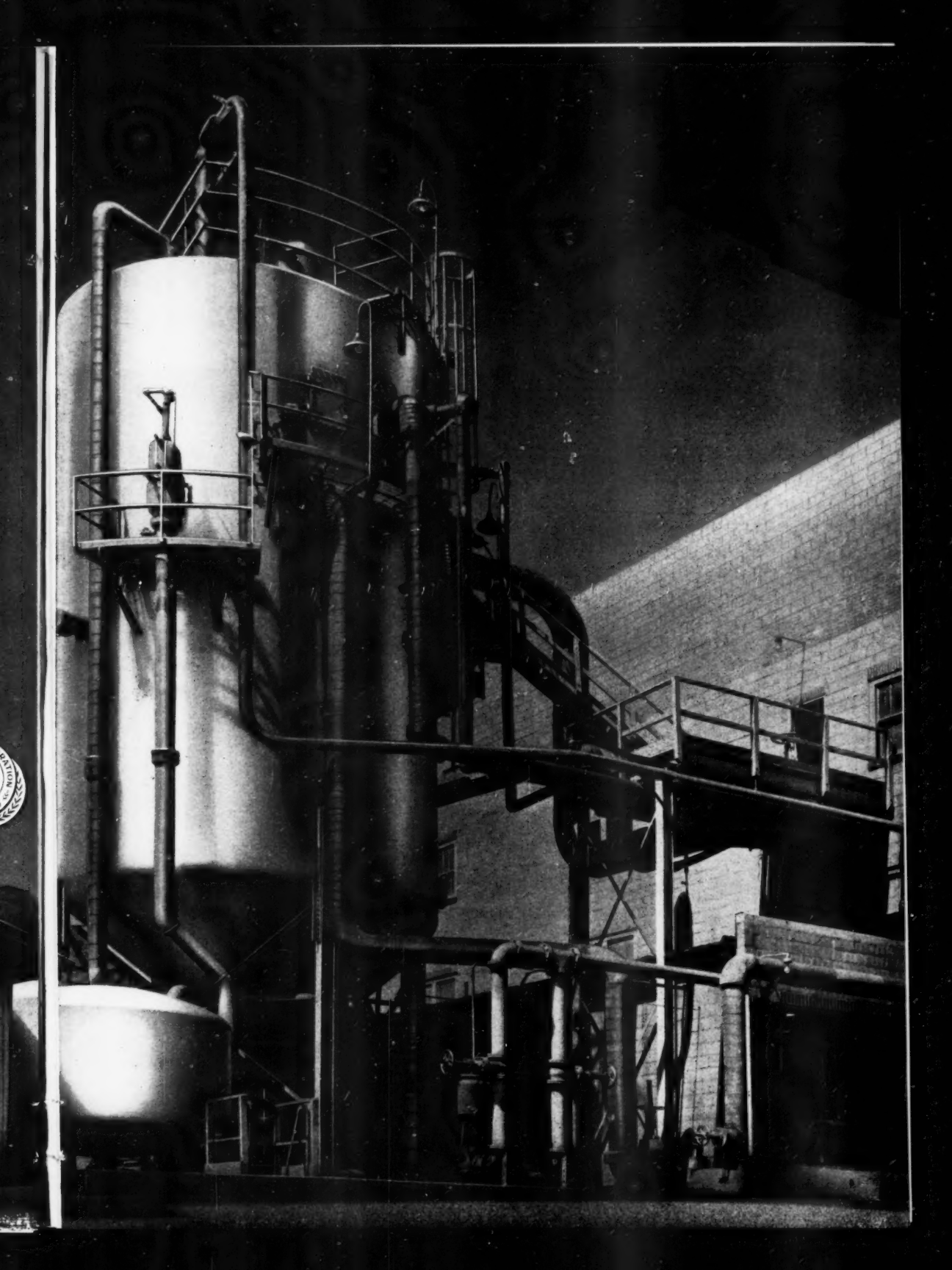
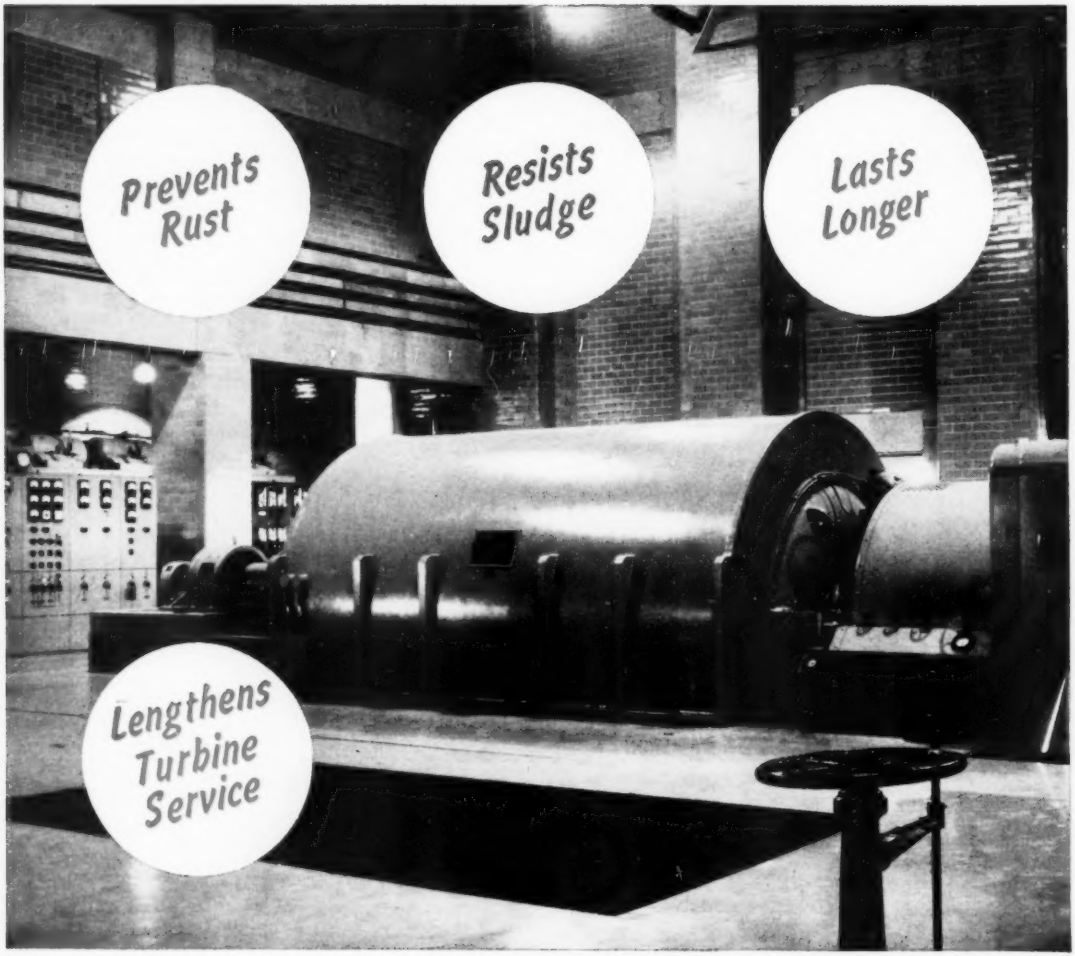
COCHRANE



Sinturlite Oils Retard Uninterrupted



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YOUR NEAREST SINCLAIR AGENT WILL GLADLY ARRANGE

Oxidation To Give Steam Turbine Service

One of the problems in steam turbine operation is the build-up of acidity in the lubricant due to oxidation. This causes harmful sludge to clog passages and impair the proper functioning of the governor.

This problem is solved when Sinclair SINTURLITE OILS are used. SINTURLITE OILS are fortified to resist oxidation and resultant acidity, retarding the formation of sludge. Other additives protect against rusting. The system is always clean, including the oil lines, bearing clearances and intricate governor mechanism. Try Sinclair SINTURLITE OILS.

Continual research explains the high quality of SINTURLITE and other Sinclair Oils. Sinclair has recently completed at Harvey, Ill., one of the most modern and complete laboratories for petroleum research and development.

E. W. Isom, Sinclair Vice-President in Charge of Research says: "With the new facilities now made available to us at Harvey, Ill., we expect to find many ways to help industry cut costs through better petroleum products."

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Fig. 19084 W.E.— Class 900 - pound Cast Steel Pressure Seal Non-return Valve. This improved design reduces to a minimum the pressure drop and turbulence encountered in conventional designs of this type of valve.

Fig. 11323 W. E.— Class 1500-pound Cast Steel Pressure Seal Gate Valve with welding ends. Has top-mounted electric motor operator for quick, positive opening and closing by remote control. →

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MUST suit the Service

It's an established fact that there's more loss in time and money through misapplication of valves than from any other known cause.

Fortunately this can be avoided. All you need to do is standardize on the Powell Line of Valves*—because this is what you get—

I More varieties and patterns than are made by any other manufacturer of valves.

II The most complete line of Standard Designs, made of standard materials, for use wherever they fill the requirements of the service.

III Many Special Designs for Special Services.

IV Valves made in the greatest variety of materials ever used in making flow control equipment.

With such facilities at your disposal and Powell Engineers always ready to help you select the right valves, why take chances with your flow control equipment Standardize on POWELL VALVES.

Fig. 375 — 200-pound Bronze Gate Valve with screwed ends, inside screw rising stem, union bonnet and renewable wear-resisting "Powellium" nickel-bronze disc.

Fig. 1708—200-pound Bronze Globe Valve with screwed ends, union bonnet, renewable, specially heat treated stainless steel seat and regrindable, renewable, wear-resisting "Powellium" nickel-bronze disc.

Fig. 1793— Large 125-pound Iron Body Bronze Mounted Gate Valve. Made in sizes 2" to 30", incl. Has outside screw rising stem, bolted flanged yoke, tapered solid wedge.

* Powell Valves are made in Bronze, Iron, Steel and a wide selection of Corrosion-Resistant metals and alloys. Valves of every type—Globe, Angle, Gate, Check, Non-return and Flush Bottom Tank Valves—are included in the Complete Powell Line.

The Wm. Powell Company, Cincinnati 22, Ohio

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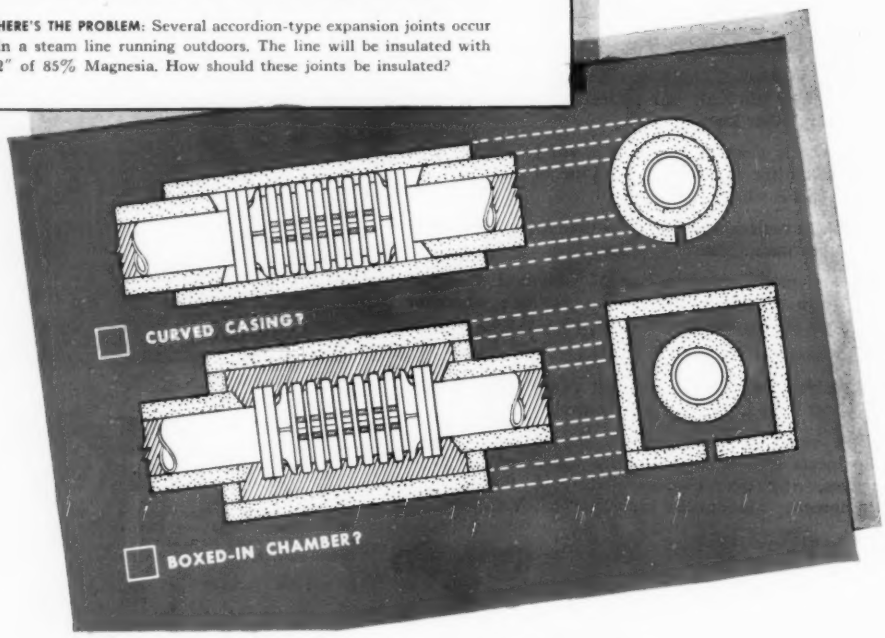
VALVES

How would you insulate this accordion joint?

HERE'S THE PROBLEM: Several accordion-type expansion joints occur in a steam line running outdoors. The line will be insulated with 2" of 85% Magnesia. How should these joints be insulated?



HERE'S WHAT THE ARMSTRONG ENGINEER RECOMMENDED:

Indoors, expansion joints of this type often can be left uninsulated. Outdoors, they are covered for protection against the weather and to reduce heat losses, particularly in winter. The conventional method is to build an insulated box around the joint. Bulky and clumsy, this box requires more insulation materials than the curved casing method and is less efficient.

That's why the Armstrong engineer recommended the curved casing method. He suggested that sheet metal be curved around the flanges, extending out beyond them 4" to 6". A small opening is left in the bottom of the metal shield to bleed off possible condensed leakage. With the exception of this opening, the metal casing is covered with 2" of magnesia block, scored and bent to fit the curve snugly and wired in place.

This outer sleeve of insulation will not buckle, crush, or split because the flanges can move freely within it. It can be weatherproofed like the rest of the line, and the casing is removable for maintenance.

Recommending the most efficient method of handling every phase of an insulation job is part of an Armstrong engineer's work. He will make a careful study of your particular problems, which often results in showing the way to important operating savings. And Armstrong's complete Contract Service provides this sound engineering advice plus the right materials and expert workmen to apply them.

FREE INSULATION CHART

This chart lists types and thicknesses of insulation for temperatures from 300° below zero to 2800° F. Write today to Armstrong Cork Co., 7008 Maple Avenue, Lancaster, Pennsylvania.

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Complete Contract Service For All Temperatures

From 300° Below Zero

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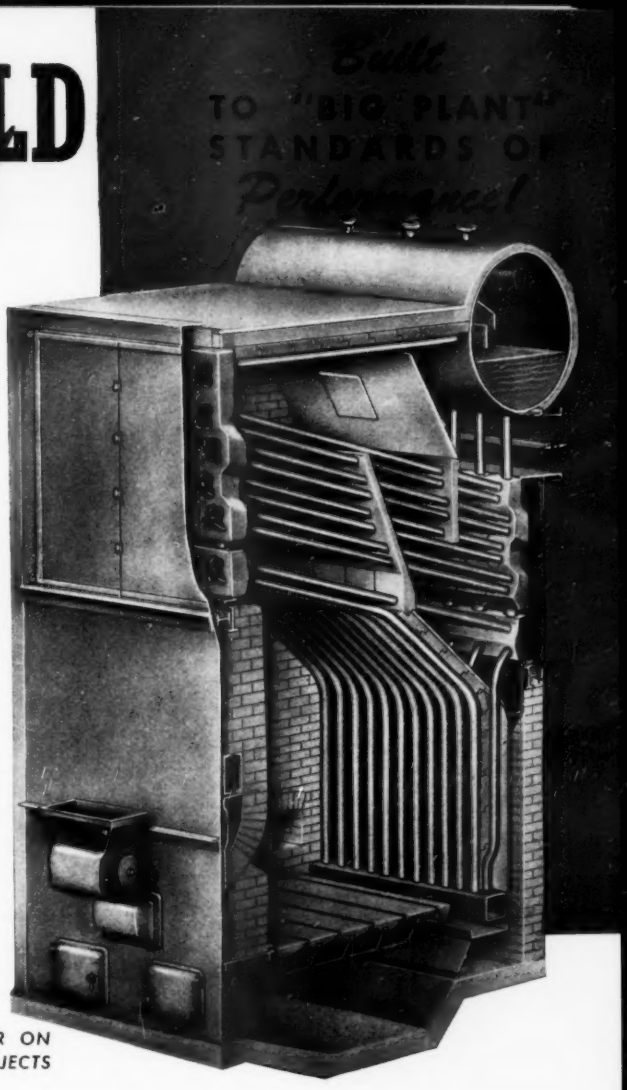
SPRINGFIELD *Standardized*

TYPE MC COAL FIRED BOILERS



Choice of Sizes —Here is Springfield's new *Standardized* Type MC boiler. Available in a wide choice of sizes to help you meet small to medium size steam plant needs with minimum delay and less capital investment.

Standardized Construction — Boilers are assembled from same component parts. Height and depth are standardized. Width varies according to number of sections used.

Coal, Oil or Gas Firing — Designed for coal firing with standard stokers. Equally adaptable to high efficiency firing with standard oil or gas burners.

Quicker Delivery — Stocks of parts are maintained for prompt assembly and shipping of units. For information on delivery, see your local Springfield representative, or write.

CHECK WITH YOUR CONSULTING ENGINEER ON YOUR MODERNIZATION AND NEW PLANT PROJECTS

SPRINGFIELD PRODUCTS

BENT TUBE STEAM GENERATORS—Modern designs for capacities from 10,000 lbs. up.

STRAIGHT TUBE BOILERS—Specially designed for capacities from 5,000 to 450,000 lbs. per hour and higher.

STANDARDIZED TYPE M BOILERS—Standardized for quicker delivery and lower cost. Sizes 7,500 to 17,000 lbs. per hour.

WATER COOLED FURNACES—Heavy duty water walls. Exclusive center water wall construction for larger units.

SUPERHEATERS — AIR HEATERS — ECONOMIZERS—Individually designed to meet requirements.

BOILER No.	510	610	710	810	712	812	912	1012
Steam Capacity, Lbs. per Hr., continuous	7,500	9,000	10,500	12,000	12,500	14,300	16,000	17,800
Heating Surface, Sq. Ft.	895	1,077	1,256	1,430	1,490	1,703	1,918	2,128
Furnace Volume, Cu. Ft. Oil or Gas	305	360	415	475	550	625	700	775
Stoker	270	320	370	424	485	555	620	690
Furnace Width	4'7½"	5'6"	6'4½"	7'3"	6'4½"	7'3"	8'1½"	9'0"
Overall Width	8'2½"	9'1"	9'11½"	10'10"	9'11½"	10'10"	11'8½"	12'7"
Overall Length	11'11¼"	11'11¼"	11'11¼"	11'11¼"	13'10¼"	13'10¼"	13'10¼"	13'10¼"
Overall Height	19'4"	19'4"	19'4"	19'4"	19'4"	19'4"	19'4"	19'4"
Furnace Depth	7'10"	7'10"	7'10"	7'10"	9'7"	9'7"	9'7"	9'7"
Steam Outlet Size	4"	6"	6"	6"	6"	6"	6"	6"
Feed Inlet Size	1½"	1½"	2"	2"	2"	2"	2"	2"
Blow Off Size	2"	2"	2"	2"	2"	2"	2"	2"

See our catalog in SWEET'S

SPRINGFIELD BOILER CO.

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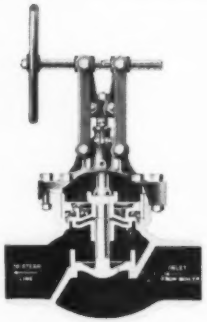
Valves

For every Service



G-A Single Acting Non-Return Valve, Toggle Yoke Design, Globe Pattern

- Non-Return Valves
- Throttle and Automatic Engine Stop Valves
- Emergency Trip Valves
- Steam and Water Pressure Reducing Valves
- Pressure Reducing and Sustaining Valves
- Pressure Reducing and Relief Valves
- Pressure Reducing and Check Valves
- Water Pressure Relief Valves
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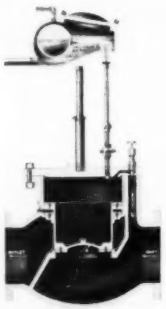
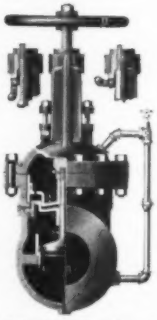
- and many other types for every service



G-A High Pressure Controlling Float Valve, Globe Pattern

Since 1905 Golden-Anderson has furnished dependable automatic control valves for some of America's most important Industrial and Power Plant applications. Choose from more than 1500 standard types, or specially designed valves to solve your most difficult *flow control* problem. Write for descriptive catalog.

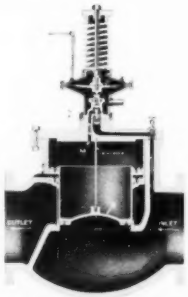


G-A Combined Throttle and Automatic Engine Stop Valve, Globe Pattern

LIFE AND PROPERTY PROTECTION
VALVES SINCE 1905

GOLDEN-ANDERSON
Valve SPECIALTY CO.

Keenan Bldg., Pittsburgh 22, Pa.

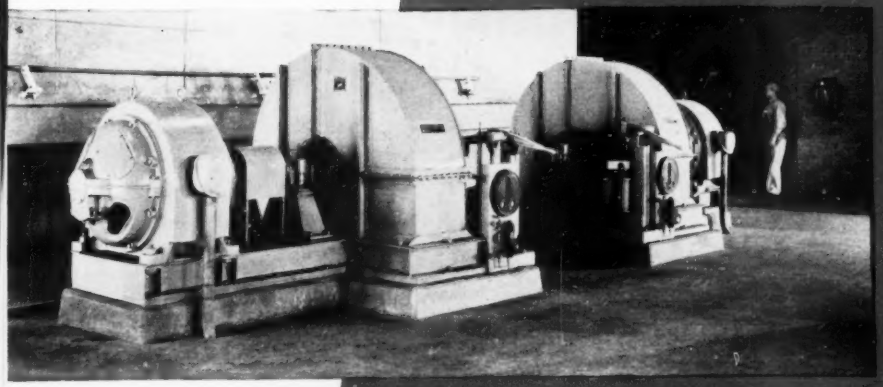


G-A Single Acting Altitude Valve, Globe Pattern

1,775,000 POUNDS

Of Super-Heated Steam Per Hour

using dependable "Buffalo" DRAFT FANS



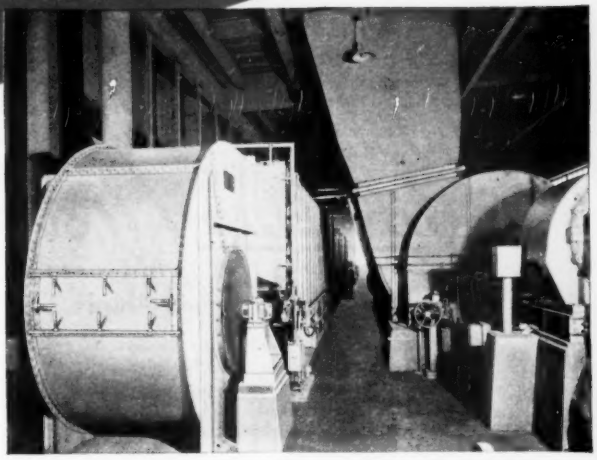
PRIMARY AIR for drying coal in pulverizer and conveying to boilers in dust form is supplied by "Buffalo" constant speed fans, two per boiler, driven by 200 HP motors. These fans HAVE to be rugged, and they are!

MODERN 60-CYCLE PLANT OF NIAGARA HUDSON SYSTEM HAS 320,000 KW INSTALLED CAPACITY

● The "Buffalo" Draft Fans you see in the photos at right are continuously supplying two boiler units at the Huntley Station of Buffalo Niagara Electric Corporation, a unit of the Niagara Hudson Power System which serves much of Western New York State.

The output of No. 65 boiler is 900,000 pounds of steam per hour at 900° F. No. 66 boiler turns out 875,000 pounds at 950° F. Each boiler is in continuous operation for a one year period.

Here is gruelling fan service! 24-hour-a-day erosion of hot fly-ash on blades and housing surfaces of the induced draft fans—week in, week out handling of enormous volumes of air by the forced draft fans and primary air fans. And these fans are doing it without letup or timeout because "Buffalo" builds them HEAVY IN THE RIGHT PLACES.



SECONDARY AIR is supplied by "Buffalo" Forced Draft Fans installed at top of boilers, two per boiler. Rotor Speed is controlled for desired volume by variable speed couplings. Forced Draft Fan at left above is driven by 400 H. P. motor. Induced Draft Fan, right, has 1250 H. P. motor.

"Buffalo" FIRST FOR FANS

BUFFALO FORGE COMPANY

488 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont., Branch Offices in all Principal Cities

VENTILATING FORCED DRAFT | AIR WASHING COOLING | AIR TEMPERING HEATING | INDUCED DRAFT EXHAUSTING PRESSURE BLOWING

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

MOTOR EXCHANGE SERVICE

For Westinghouse
single-phase and three-phase
1 to 20 hp
frame 203 to 326 a-c motors

Another Life-Line First!

The Broadest Exchange Plan!

Since February, 1949, Life-Line motors have offered you the broadest exchange plan in industry. All 1 to 20-hp, single-phase and three-phase a-c motors in frame 203 to 326 are included. No other manufacturer of motors—large or small—provides exchange service that compares in scope to this new Life-Line Motor Exchange Service.

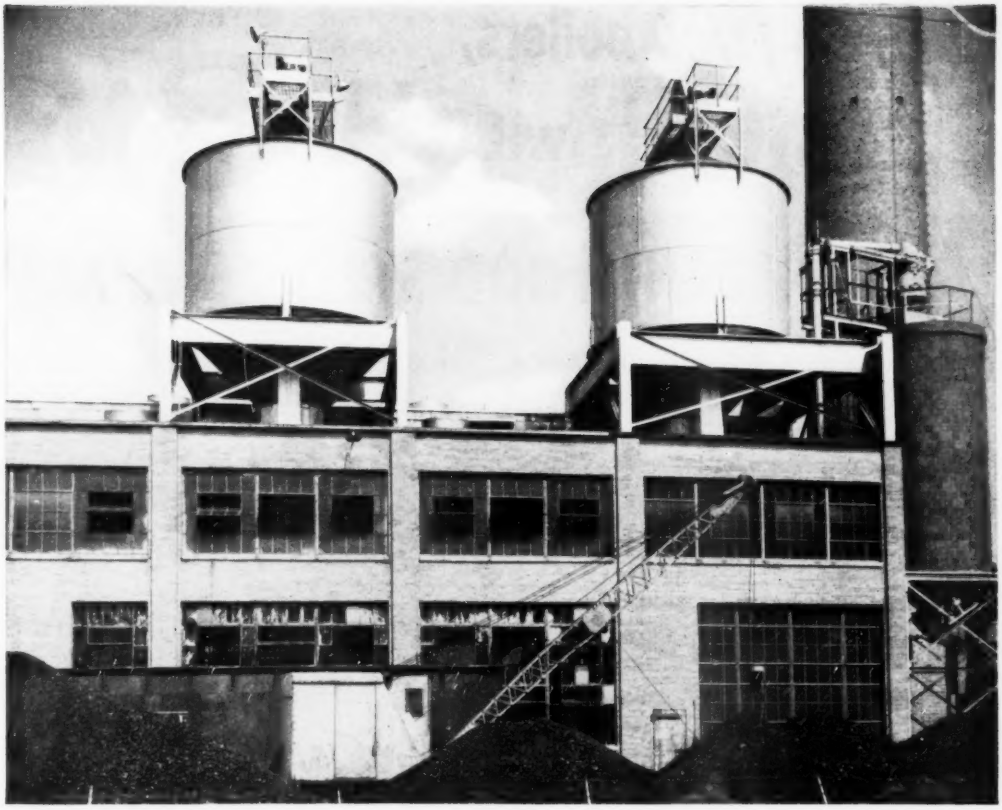
120 Westinghouse exchange points assure you rush motor replacement service anywhere in the United States. Replacement motors, covered by this plan, are in stock, ready to be speeded to you at any time.

And what's more, if a motor fails during warranty period, it may be exchanged *free* for a motor of identical rating. The *exchange price,* beyond warranty, *is not dependent on the time in service . . . one year, five years or ten years.*

This service is one more advantage you get with Life-Line motors. Add this to all-steel construction . . . pre-lubricated bearings . . . an indicated savings of $750 per year per 100 motors . . . and you'll see why Life-Line has gained leading acceptance in the motor industry.

Complete details on the Life-Line Exchange Service—lists of exchange points and motor ratings covered—are given in the new booklet SM-5243. Get your copy today from your nearby Westinghouse representative or write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Penna. J-21533

Westinghouse *Life-Line* **Motors**



Handling COAL like WATER

—and as Cleanly

By installing two dust-tight REDLER Conveyor-Elevators with intakes at the bottom of track hoppers, S-A engineers have made coal literally flow like water. At 25 tons an hour, the Redlers "pump" coal into overhead storage bins, from which it is spouted directly into the boiler stokers. This has cleaned up a costly handling job and made possible a boiler room that is free of coal dust and dirt.

The solving of bulk materials handling problems to meet individual needs at lowest handling cost per ton has been the job of S-A engineers for half a century. With their great backlog of bulk handling experience, *plus* the complete S-A line that includes every type of bulk materials handling equipment, they can recommend the particular type and design of conveying system best suited for any given conditions.

If you have a problem in bulk materials handling, it's always a good idea to get the recommendations of S-A engineers—*first*. Write today.

GOODYEAR TIRE AND RUBBER COMPANY
ST. MARYS, OHIO

Two L-shaped REDLER Conveyor-Elevators, lift coal from track hoppers to two cylindrical, 150-ton capacity steel storage bins on the roof. Each REDLER has a handling capacity of 25 tons per hour. The coal is spouted by gravity directly into boiler stokers below. The compact design of the REDLER casing saves space, enables a simple, light-weight installation. The dust-tight REDLER keeps the boiler room clean. Fast efficient handling reduces handling cost per ton.

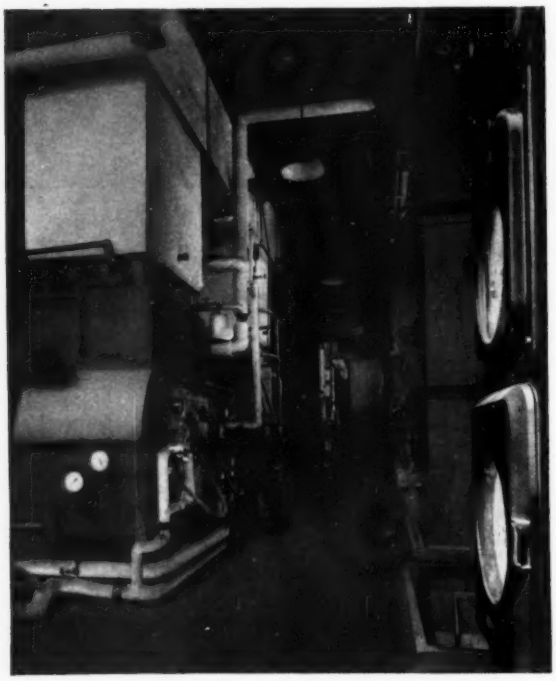
STEPHEN S-A DAMSON MFG. CO.

5 Ridgeway Avenue, Aurora, Illinois · Los Angeles, Calif. · Belleville, Ontario

DESIGNERS AND MANUFACTURERS OF ALL TYPES OF BULK MATERIALS HANDLING EQUIPMENT

Three-fuel boilers, with HAGAN at ALAN WOOD STEEL COMPANY

The two new boilers in the Blast Furnace division of the Alan Wood Steel Company, Conshohocken, Pa., were designed to use blast furnace gas when it is available, coke oven gas when there is an unsold surplus, and Bunker C fuel oil when necessary.



General view of boilers. H. M. Wilson Co., Philadelphia engineering and construction firm were consulting engineers on this installation.

Each boiler has a capacity of 150,000 lb./hr. They are presently operating at 165 p.s.i., but are designed for operation at 700 p.s.i. to meet future requirements.

Heat content of the blast furnace gas is approximately 90 B.t.u.'s per cubic foot; of the coke oven gas, 540 B.t.u.'s per cubic foot; and of the fuel oil 150,000 B.t.u.'s per gallon. Blast furnace gas pressure varies from 5″ to 25″.

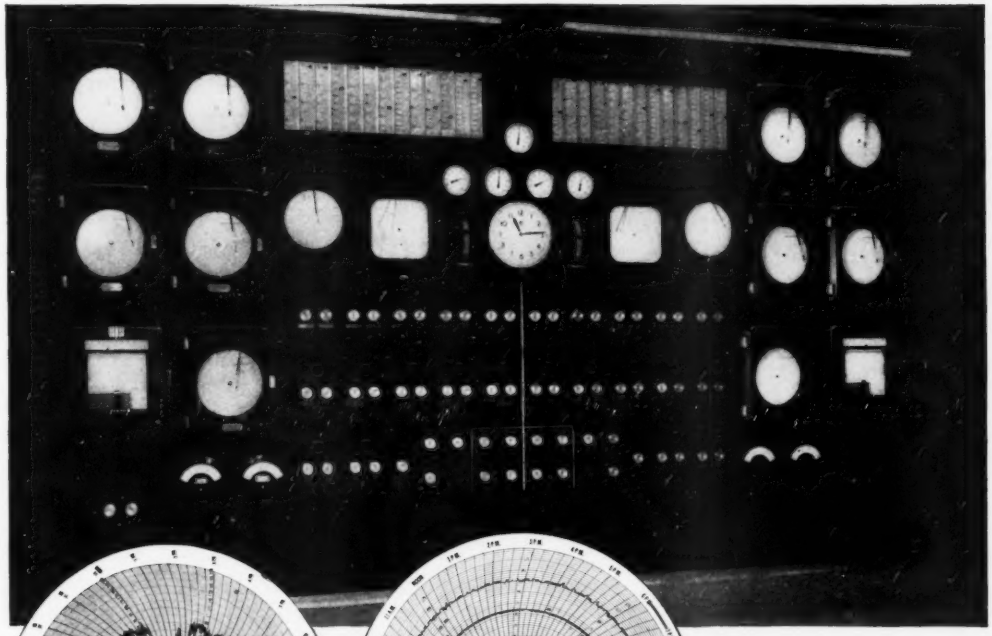
In spite of these variables, and of wide swings in steam load, the proper air-fuel ratio and the desired steam pressure are automatically maintained by the Hagan Differential Master system of combustion control.

Two fuel combinations are employed—blast furnace gas and oil, and coke oven gas and oil. Changes from gas to oil and oil to gas are automatic, but selection of the type of gas to be used is, in this installation, made manually. The charts reproduced at right show how the oil "takes over" to compensate for any deficiency in gas supply.

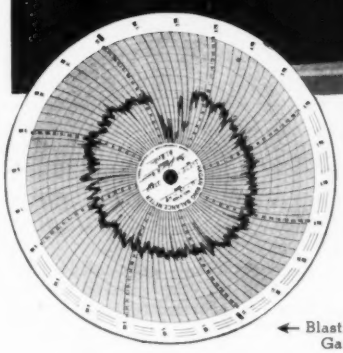
The Hagan Ring Balance Meters shown on the panel are used to measure and record gas flow, steam flow, and boiler water level. Two others, mounted on separate panels, measure flow of coke oven gas to the pilot burners.

For full information on Hagan Control and Hagan Ring Balance Meters, write to Hagan Corporation, Hagan Building, Pittsburgh 30, Pa.

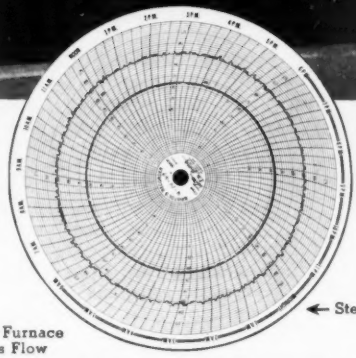
Controls and Meters



Control Panel of Hagan Differential Master installation at Alan Wood Steel Company. Ten Hagan Ring Balance Meters are mounted on the panel, two more are mounted on separate panels.

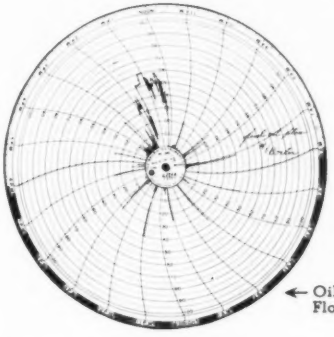


← Blast Furnace Gas Flow



← Steam Header Pressure (inner record)

Upper chart at left shows gas flow in one burner. "Valleys" in this chart are matched by peaks in the lower chart (oil flow). For the most part, it will be noticed, these "oil on" periods are of brief duration, but the charts show one period of several hours during which gas was off. The inner circle of the chart at the right shows how the Hagan Control maintained steam pressure under these conditions.



← Oil Flow

HAGAN CORPORATION

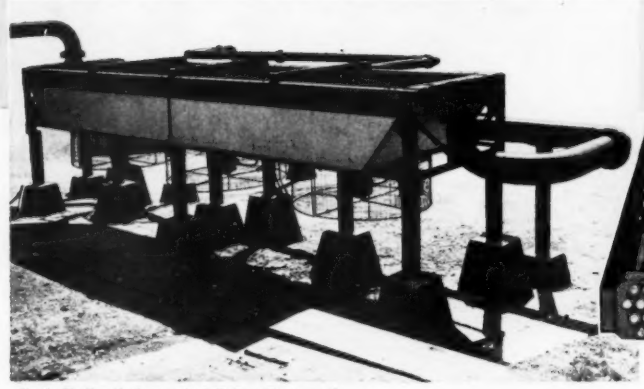
BOILER COMBUSTION CONTROL SYSTEMS
RING BALANCE FLOW AND PRESSURE INSTRUMENTS
METALLURGICAL FURNACE CONTROL SYSTEMS
THRUSTORQ FORCE MEASURING DEVICES

Water Piping
Water Pumps
Water Treatment
Water Disposal
Water Freeze-Up
Water Corrosion

All these water problems and expenses eliminated by

FIN-FAN

THE AIR-COOLED EXCHANGER



Single Fin-Fan Exchanger installed on the ground.

G-R K-Fin Air-Cooled Section used in the Fin-Fan Exchanger.

FIN-FAN . . . the *Air-Cooled* Condenser or Cooler developed jointly by The Griscom-Russell Co. and Fluor Corporation Ltd., completely solves the cooling water problem . . . by *eliminating* the cooling water.

That's FIN-FAN benefit No. 1. FIN-FAN'S wide adaptability is its No. 2 benefit. These units are being used for cooling solutions, process liquids, lubricating oil, gear oil, quenching oil, petroleum fractions, jacket water, and compressed gases, and for condensing exhaust steam, hydrocarbon vapors, and refrigerating vapors. A single installation can be used for two or more cooling and condensing duties simultaneously.

And FIN-FAN has many additional advantages. It can be installed wherever convenient . . . within a building, on a roof, or on the ground. Its effectiveness is entirely independent of the direction or velocity of the wind. It can be operated by any available source of power. Its construction is particularly sturdy and durable, capable of withstanding high temperatures and pressures.

Write for Bulletin 1231 describing these many-purpose, many-benefit units in detail and for recommendations for your heat transfer needs.

THE GRISCOM-RUSSELL CO., 285 MADISON AVE., NEW YORK 17, N. Y.

GR-230

GRISCOM-RUSSELL

PIONEERS IN HEAT TRANSFER APPARATUS

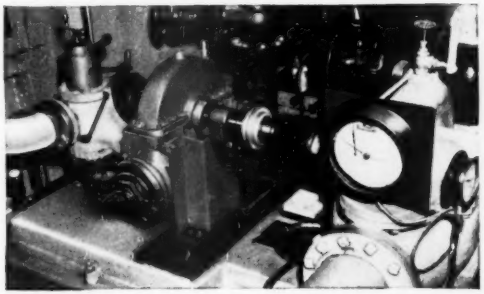
TURBINE TIPS

no. 2

question: When is turbine power really a bargain? . . .

answer:

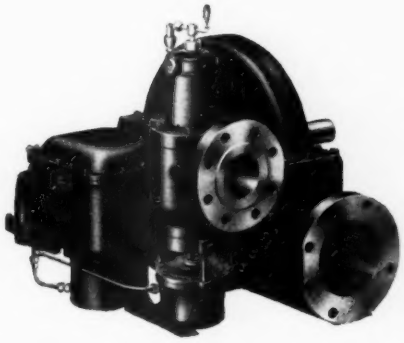
When low-pressure steam (5 to 100 lb) is needed for process requirements such as heating, drying, cooking; or for service requirements such as building heating, feed-water heating, etc. For instance, this turbine installation uses boiler steam to drive a centrifugal pump, then exhausts low-pressure steam for heating use. The turbine only takes a small portion of the heat from the steam—from 10 to 20 per cent—leaving the balance for other use. Thus the mechanical power produced is almost free.



question: When is a turbine a bargain? . . .

answer:

When the design embodies many outstanding features—all in a standard machine at standard price. Take, for instance, a turbine like G-E's standard Type DP. The DP incorporates many features of larger "special" designs—wide range hydraulic governing, pressure lubrication, balanced valves, and many others. Yet, thanks to superior design and greater standardization, these features are all yours at no extra cost.



question: Where can I "get the facts" when considering a turbine application? . . .

answer:

Just call or write the nearest G-E Apparatus Sales Office. Your G-E sales engineer will gladly give you complete data on the application of turbines to your mechanical drives—and full information on the many outstanding features *standardized* in G-E turbines. *Apparatus Department, General Electric Co., Schenectady 5, N. Y.*

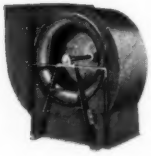
GENERAL ELECTRIC

WHY CINCINNATI GAS & ELECTRIC SPECIFIES STURTEVANT E-R WHEELS-- AGAIN AND AGAIN

UNIT
AIR CONDITIONERS

REFRIGERATION
COMPRESSORS

Everything that puts air to work for Every application

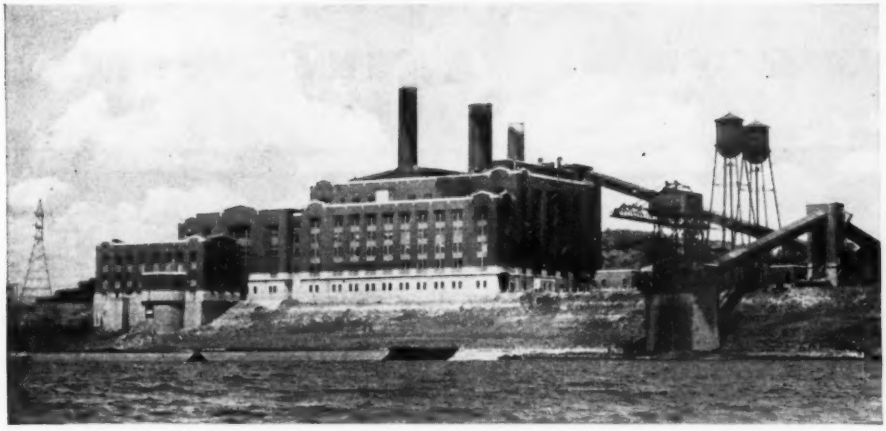


INDUSTRIAL FANS

UNIT HEATERS

VANE CONTROL®

J-80143



MIAMI PORT STATION, CINCINNATI GAS & ELECTRIC COMPANY

Fly-ash: Problem • Solution • Result

Fan wheel abrasion by fly-ash, always a problem, becomes increasingly severe as capacity ratings rise. But, with the exclusive design of the Sturtevant E-R (Erosion Resistant) Wheel, concentrated streams of fly-ash from both inlets *attack each other*—not the wheel—because center plate is cut away between blades. Special ribbed liners also armor the E-R Wheel against abrasion. Instead of renewing the whole wheel, merely replace these liners—easily, quickly . . . at much less cost. *Result.* Under severe fly-ash conditions, a comparative test by engineers of Cincinnati Gas & Electric showed these facts—which speak for themselves:

Standard Wheel	Sturtevant E-R Wheel*
14 Months	35 Months
8,626 Hours	22,407 Hours
85,126 Tons of Coal	280,093 Tons of Coal

*wearing pads replaced once—still in service when figures were obtained.

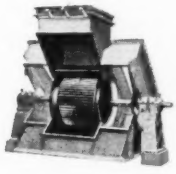
Cincinnati Gas & Electric Co. uses the Sturtevant E-R Wheel in these units at Miami Fort Station: Unit 3, installed 1938; Unit 4, installed 1942; Unit 5, now being installed; Unit 6 (West End Station), installed 1949.

What This Means To You

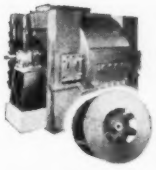
With the E-R Wheel, you can step up the life expectancy of induced draft fan wheels from 2 to 4 times. Get in touch with your nearest Sturtevant office. Or, write the Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.

Westinghouse
Sturtevant Division

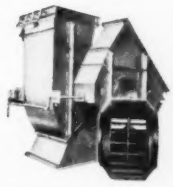
FORCED DRAFT FANS
(Turbovane®)



INDUCED DRAFT FANS
(Multivane®)



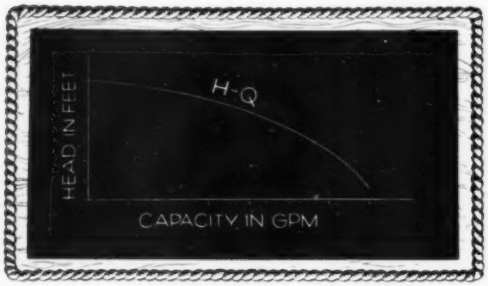
INDUCED DRAFT FANS
(Steel Plate)



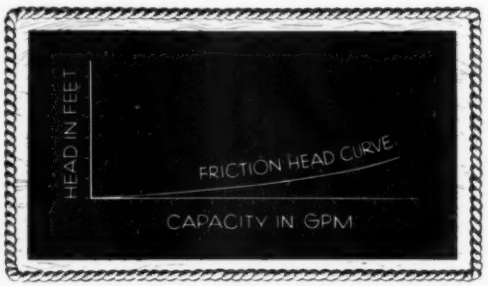
INDUCED DRAFT FANS
(Turbovane®)

Pointers on Pumps

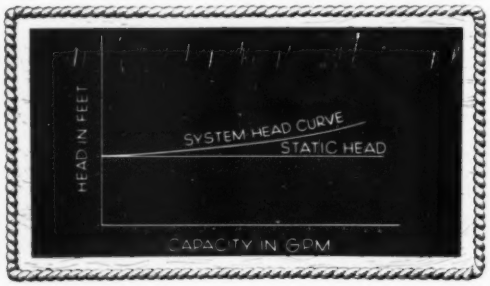
HOW MUCH WILL A CENTRIFUGAL PUMP DELIVER?



1 The capacity of a constant speed centrifugal pump whose head capacity characteristics (H-Q) are shown in Figure I on any piping system can be determined as follows:

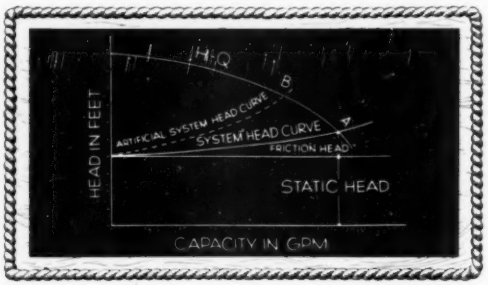


2 Plot the friction loss through all piping, valves and fittings at different rates of flow. Use any standard friction tables, making allowances for age and condition of pipes.



3 Static Head is the difference between liquid levels in suction and discharge vessels plus the algebraic difference of pressure, between suction and discharge vessels, expressed in feet. Combining the friction head curve at different rates of flow with the static head gives the system head curve, which is total head in feet*.

*See method of calculating head described in previous advertisement in this series. We will gladly send you a copy.



4 When the head capacity curve (Figure I) is superimposed on the system head curve, (Figure III) the intersecting point "A" is the capacity that will be delivered by the pump on this system. If a smaller capacity is desired, partial closing of the discharge valve will produce an "artificial" system head curve, giving capacity at point "B". Any capacity between point "A" and shut-off (zero capacity) may be obtained by adjusting discharge valve.

ANY OTHER PROBLEMS?

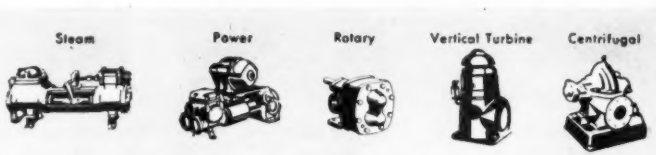
Worthington's engineering department — backed by the longest and broadest experience in the field — will do its best to solve them. Because in addition to making the most complete line of pumps, Worthington makes its technical service fulfill the promise that *there's more worth in Worthington . . .*

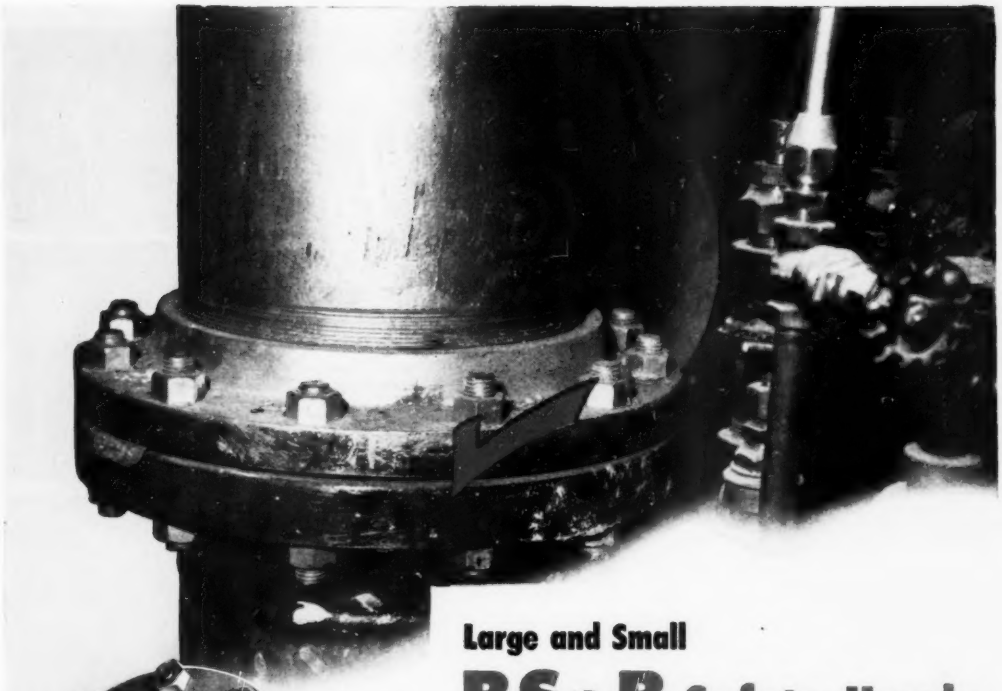
Contact our nearest District Office, or write to *Worthington Pump and Machinery Corporation, Centrifugal Pump Division, Harrison, N. J.*

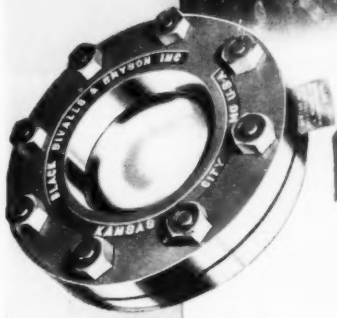
WORTHINGTON

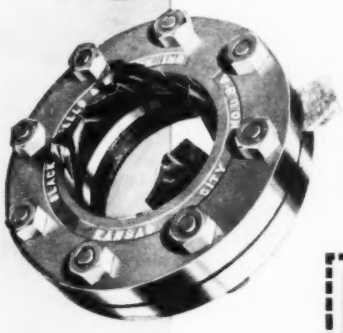
C9-1

THE WORLD'S BROADEST LINE ASSURES YOU THE RIGHT PUMP FOR EVERY JOB









Large and Small

BS&B Safety Heads

protect lives and property against Over pressure

In the picture, a 24-inch Black, Sivalls & Bryson **SAFETY HEAD** — largest in standard diameters — stands sleepless guard over life and property in a chemical plant.

The **SAFETY HEAD** is gauged to burst at a predetermined pressure well below safety limits of the protected autoclave. For that reason the vessel, in which live steam can swiftly build up enormous pressure, *will not fail* — because the **SAFETY HEAD** will blow *first* and provide instant, full-diameter relief!

If your plant is not under this sure and enduring protection, note this fact: no vessel protected by **BS&B SAFETY HEADS** has ever exploded. Fill out and mail the coupon below **TODAY** for further information!

BS&B SAFETY HEADS

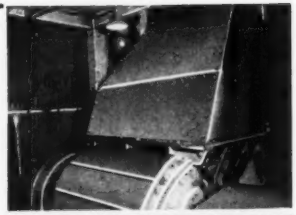
Director, Special Products Division, BLACK, SIVALLS & BRYSON, INC.
Section SH-6, Power and Light Building, Kansas City 6, Missouri

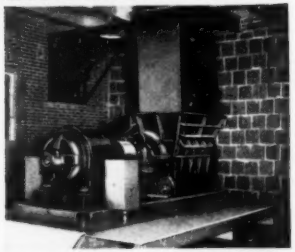
I want full details concerning BS&B SAFETY HEADS.
☐ Please forward complete data.
☐ Arrange to have a Sales Engineer call on me.

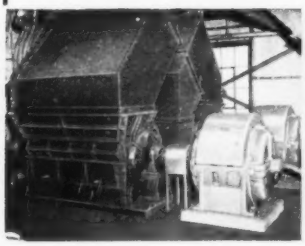
NAME .....
FIRM .....
ADDRESS .....
CITY ..... ZONE ..... STATE .....

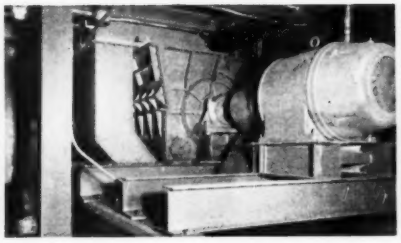
A COMPLETE COAL CRUSHING OPERATION in less than 12′ x 12′ x 12′

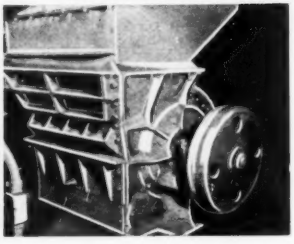
American Rolling Ring Crushers provide high tonnage reduction with controlled uniform sizing



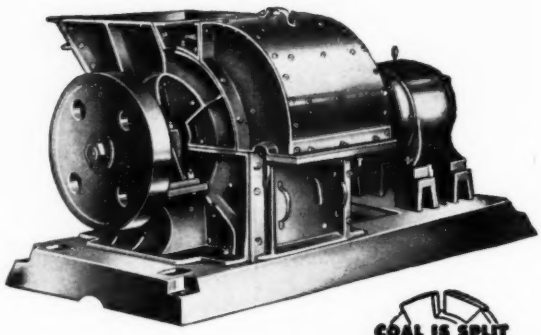








Americans are contributing to greater firing efficiency in power plants everywhere. ROM coal is rapidly reduced to stoker or pulverizing sizes in one low-cost operation. A complete, compact crushing operation requiring only minimum headroom and no auxiliary crushing or breaking units, Americans incur little or no extensive plant alterations. American Rolling Ring Crushers are built in capacities up to 500 TPH.



Only Americans offer the patented shredder ring action that *splits coal* by efficient cleavage action of multiple cutting edges.

COAL IS SPLIT - NOT CRUSHED

Get the data on improved coal preparation— Send for Americans "S" Crusher Bulletin.

American PULVERIZER COMPANY

Originators and Manufacturers of Ring Crushers and Pulverizers

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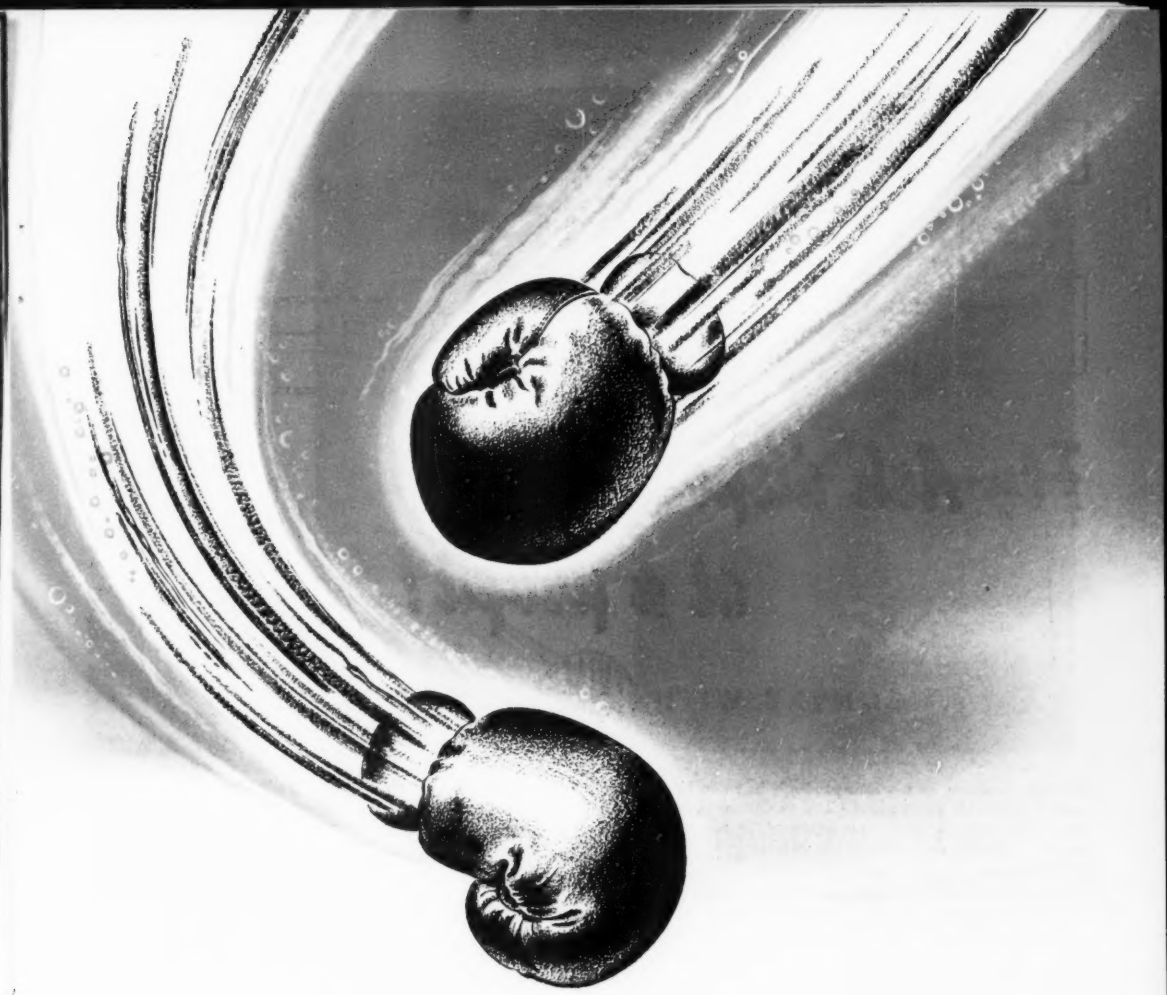

Give water a quick *one-two!*

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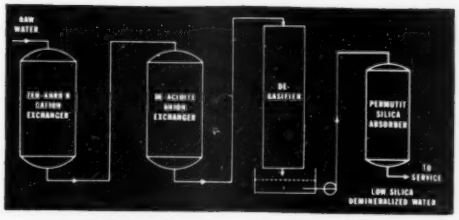

This new Permutit® chemical process can mean tremendous savings for your plant. This is only one of many Permutit services designed for power plants. For full information about equipment specifications and applications, write to The Permutit Company, Dept. P-8, 330 West 42nd Street, New York 18, N. Y., or to the Permutit Company of Canada, Ltd., Montreal.

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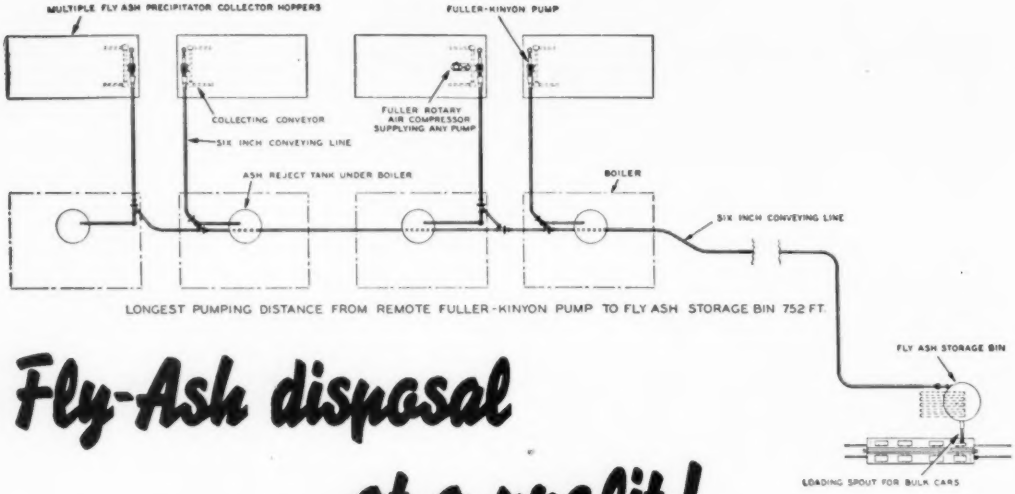
FOR OVER 35 YEARS
WATER CONDITIONING HEADQUARTERS


MULTIPLE FLY ASH PRECIPITATOR COLLECTOR HOPPERS
FULLER-KINYON PUMP
COLLECTING CONVEYOR
FULLER ROTARY AIR COMPRESSOR SUPPLYING ANY PUMP
SIX INCH CONVEYING LINE
ASH REJECT TANK UNDER BOILER
BOILER
SIX INCH CONVEYING LINE
LONGEST PUMPING DISTANCE FROM REMOTE FULLER-KINYON PUMP TO FLY ASH STORAGE BIN 752 FT.
FLY ASH STORAGE BIN
LOADING SPOUT FOR BULK CARS

Fly-Ash disposal at a profit!

CONVEY WITH FULLER KINYON PUMPS

Fly-ash need not be a waste-product, but can be turned into a profitable by-product. It's no longer necessary to flood your property with this material, as has been done by many large power-generating stations in the past.

It has been found that the use of fly-ash is beneficial in the manufacture of many concrete products, such as, for example, cement bricks and blocks, concrete soil pipe, and ready-mix concrete. Large quantities are now being purchased in various parts of the country by manufacturers of such products.

The Fuller-Kinyon Conveying System has been installed in several power plants for conveying dry fly-ash to storage, for shipment either in bulk in railroad cars, or packing in bags. This conveying system is dustless and economical, the material being conveyed, either hot or cold, through pipe lines. An excellent example of such a system is illustrated in the drawing above, recently installed in an Eastern generating station. Three Fuller-Kinyon Pumps are now installed, with a fourth to be installed later. Each pump is designed to convey hot fly-ash from multiple precipitator hoppers, at a rate of 18 to 26 tons per hour, (depending on the density of the ash) to ash reject tanks under respective boilers, or to ash storage, for commercial disposition.

A Fuller Rotary Single-stage Compressor serves all of the pumps. The pumps operate alternately, permitting an eight-hour accumulation of ash in each group of hoppers, to allow the respective pump to unload this accumulation in two hours or less.

If you have a fly-ash disposal problem, why not have a Fuller engineer make a study of your plant and make suggestions how to remedy the condition We'll be glad to do this, with no obligation on your part.

FULLER COMPANY
CATASAUQUA—PENNSYLVANIA

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P-107

Metallurgical Research conducted continually by recognized specialists who have made major contributions in this field.

Unique Technical Backing of an extensive organization with an international reputation in both process and fabrication engineering.

Complete Facilities for the fabrication of steel products from simple forgings to the most intricate 120 foot towers.

Top Welding Performance assured by specially designed equipment and exclusive employment of master operators.

Quality Control embracing the constant application of the most advanced inspection methods, both visual and non-destructive.

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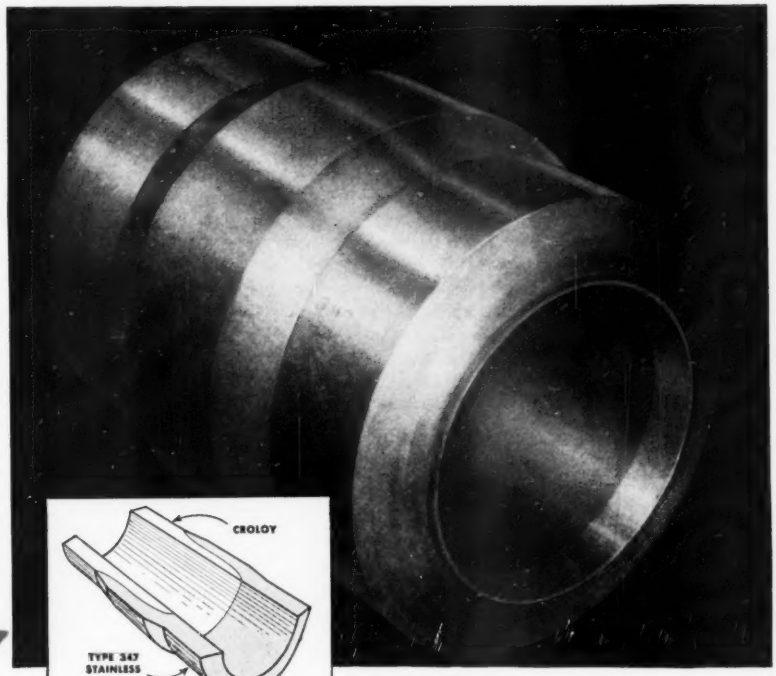


This had never been done before!

IN the first high-pressure power generating units to operate at 1050° F, just completed by the New Jersey Public Service Electric and Gas Company at Sewaren, N. J., Kellogg received the contract to fabricate and supervise installation of the main steam piping. This high operating temperature posed many perplexing problems.

But the most unusual problem concerned something that *had never even been attempted before* under such high temperature conditions. This is the story.

Boiler leads were 3% chrome-1% moly steel. The turbine throttle valves were Type 347 stainless steel. They had to be connected. However, engineers felt that welding these two diverse metals together might prove a weak point in the system because of the great difference in their coefficients of expansion.

Kellogg studied the problem and came up with the suggestion of creating *a completely new type of transition piece*, one end of which would be chrome-moly and the other stainless steel so that similar metals would be welded together. But the creation of such a piece was no simple task.

First, by their exclusive electric-ingot process, Kellogg cast the stainless steel section integrally on a chrome-moly forging. A special alloying technique was employed in the casting process which resulted in a gradual transition in analysis from one metal to the other. The piece—pure chrome-moly at one end and pure stainless at the other—was then machined to the correct inside diameter and outside dimensions.

Although a dramatic one, this is just another example of Kellogg's unusual accomplishments in the field of high temperature piping. Every day brings to light some instance where the metallurgical knowledge and unmatched facilities of Kellogg contribute to the successful solution of some new problem—producing an ordinary piece of equipment in a slightly better form or evolving an entirely new and more efficient way of performing some unusual task.

To master temperature, pressure and chemicals use

M. W. KELLOGG

process equipment

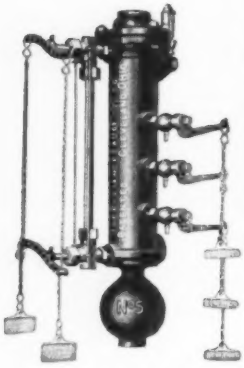
VESSELS • EXCHANGERS • CONDENSERS • HIGH PRESSURE AND HIGH TEMPERATURE POWER PIPING PROCESS PIPING • FORGED AND WELDED FITTINGS . . . IN ALL STEELS, ALLOYS OR SPECIAL COMBINATIONS

The M. W. Kellogg Company, Inc. (A Subsidiary of Pullman, Inc.) — Offices in New York, Jersey City, Buffalo, Los Angeles, Tulsa, Houston, Toronto, London and Paris.

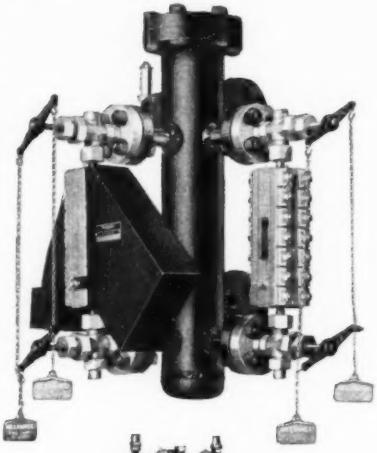
Reliance ...Your source of complete supply for *Basic* BOILER SAFETY EQUIPMENT

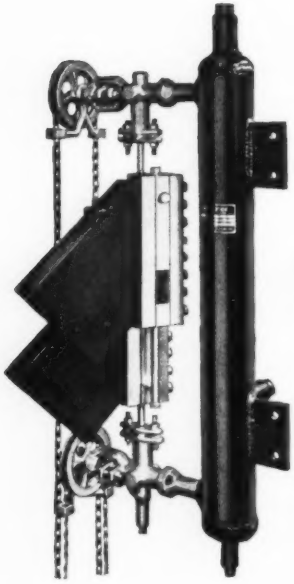
First Choice of Boiler makers and Consulting engineers

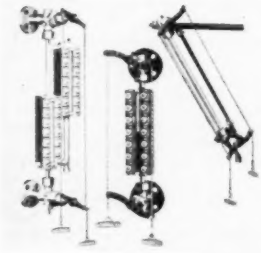
Water Columns and Gages are *basic* equipment you *must add* to your boiler when installed, or order with it from your boiler maker. Reliance offers you the most complete service in approved devices for water level supervision — always in tune with latest developments and techniques in power production. Known the world over for accuracy, sturdiness and dependability, there's a Reliance Water Column for every type of boiler — any pressure — and gage equipment for every water level checking need:



• High and low Alarm Water Columns • Water Columns without alarm • EYE-HYE Remote Reading Water Level Indicator • EYE-HYE with graduated face plate for tanks & vessels • EYE-HYE for unusually wide liquid level variations • Gage Valves • Gage (try) Cocks • Junior Water Level Alarms • Prismatic Water Gage Insert • Mica-protected Flat Glass Insert • Micasight Safety Water Gage Insert • Water Gage Illuminating Equipment







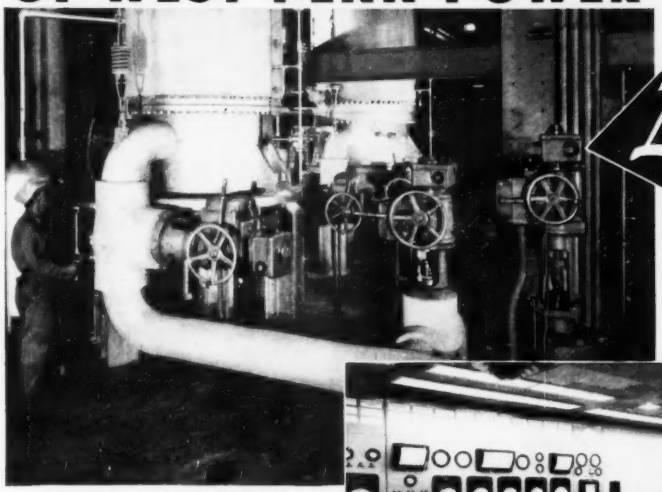
Representatives in all principal cities, or write the factory for catalogs and information.

BOILER SAFETY DEVICES since 1884

Reliance

THE RELIANCE GAUGE COLUMN CO. • 5902 CARNEGIE AVENUE • CLEVELAND 3, OHIO

MITCHELL STATION
OF WEST PENN POWER COMPANY...



ALSO USES *Limitorque*

MOTOR OPERATED
VALVE CONTROLS

ABOVE: High pressure feedwater heater, rear, and intermediate heater, foreground, are valved so that either heater can be by-passed.

RIGHT: Control for all boilers and turbine-generators, including *Limitorque Valve Operators* is concentrated at this central point.

Hundreds upon hundreds of valves on land and sea—for every conceivable use, are being safely, speedily and dependably opened and closed by "*LimiTorques*", day in and day out.

"Mitchell Station," the latest operation of the West Penn Power Co., is located at Courtney, Penna., on the bank of the Monongahela River . . . when completed it will develop in excess of 320,000 K.W.

As in many other nationally known Central Stations throughout America, *Philadelphia LimiTorque Valve Operators* will be used; in fact, a total of 35 type "S" *LimiTorques* will be installed for Steam and Water Lines on opening, closing and throttling service. Sizes of valves range from 6" to 48" and from 125# series to 1500# series.

The Valves in this station actuated by *Limitorque Controls* were manufactured by: Chapman Valve Mfg. Co.; Kennedy Valve Mfg. Co.; Walworth Co., and Northern Equipment Co.

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ERIE AVE. AND G ST., PHILADELPHIA 34, PA.
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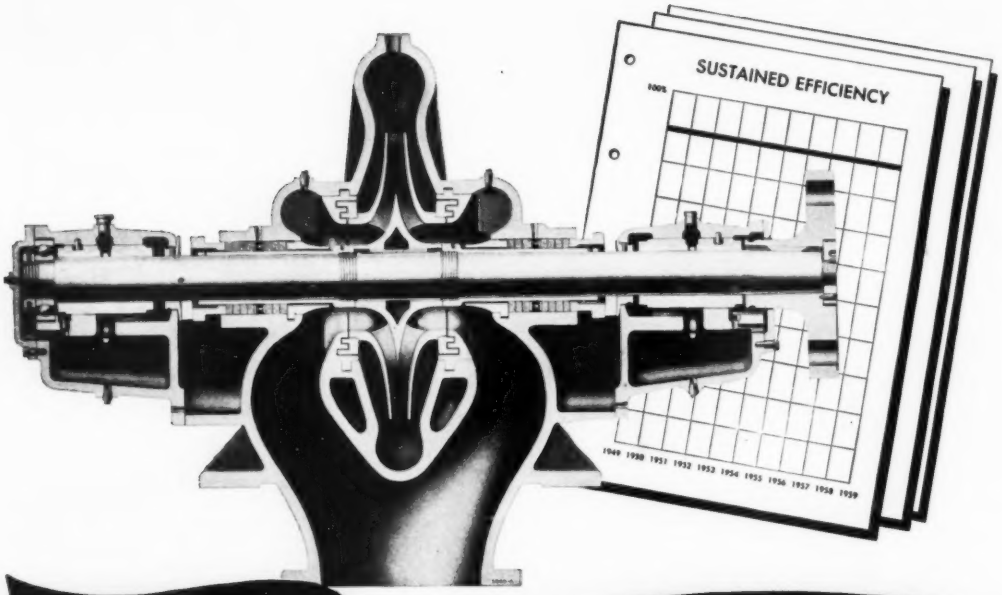
Industrial Gears and Speed Reducers
LimiTorque Valve Controls



DE LAVAL
LABYRINTH RINGS

KEEP PUMP EFFICIENCY HIGH!

Here's why: Look at the diagrams at the right and you can see how the leakage from discharge to suction at the running joint is kept to an absolute minimum by the flow retarding action of the labyrinth passages.

Unlike a flat ring, the De Laval large clearance labyrinth ring does not depend upon close clearances, subject to wear and enlargement. The flow retarding action of the labyrinth keeps efficiency high for the life of the pump and you benefit by low power costs and low maintenance year after year.

When you buy a centrifugal pump, *specify De Laval*... it pays in the long run.

De Laval large clearance labyrinth wearing ring. Note flow retarding action of tortuous passage.

Ordinary flat wearing ring. Note that flow retarding action depends upon close clearances.

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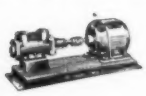
DE LAVAL STEAM TURBINE COMPANY • TRENTON 2, NEW JERSEY



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TURBINES • HELICAL GEARS • WORM GEAR SPEED REDUCERS • CENTRIFUGAL PUMPS • CENTRIFUGAL BLOWERS & COMPRESSORS • IMO OIL PUMPS

POWER

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AUGUST 1949 • VOL. 93 • NO. 8

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TRANSMISSION, LUBRICATION
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INSTRUMENTS, CONTROLS
PUMPS, COMPRESSORS

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Cover photo shows outdoor boilers and auxiliaries at Sewaren plant. For story, see page 98.

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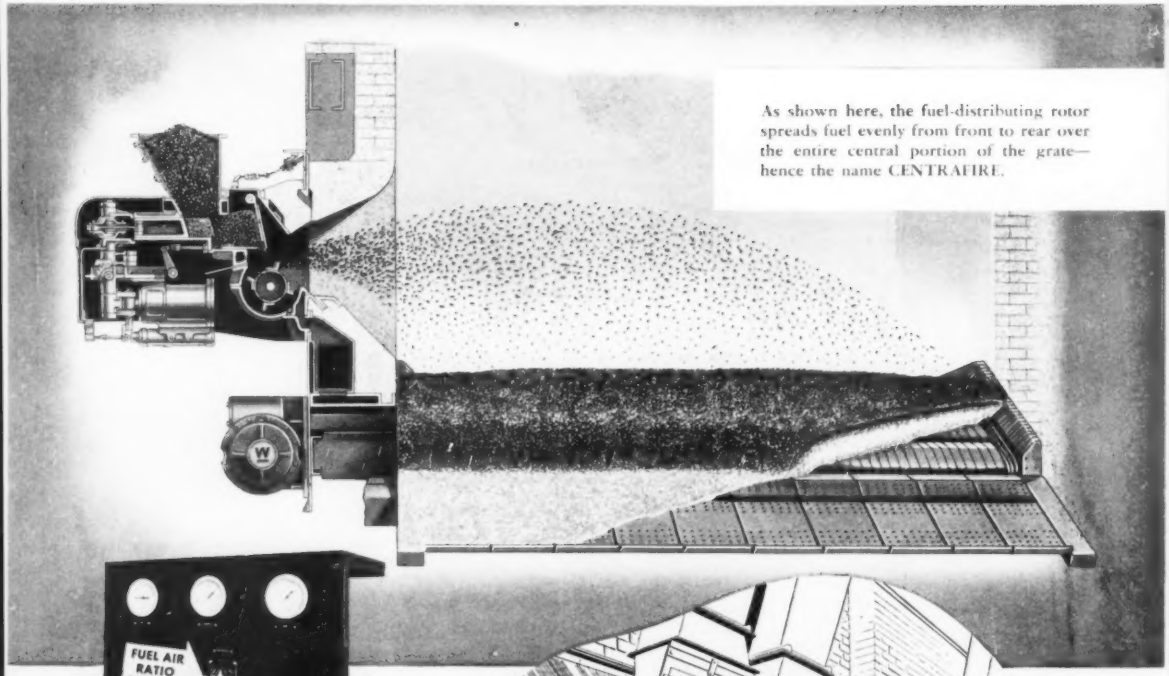
YOU CAN BE **SURE**.. IF IT'S

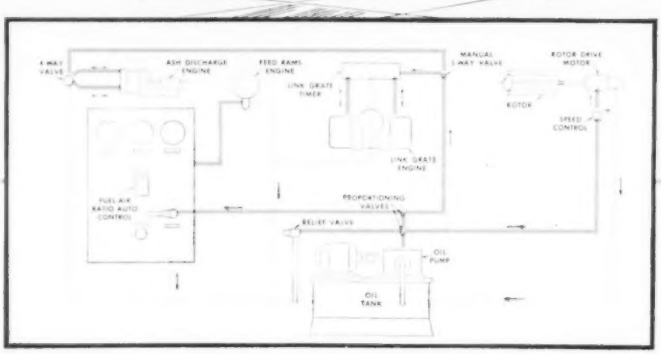
Westinghouse



As shown here, the fuel-distributing rotor spreads fuel evenly from front to rear over the entire central portion of the grate—hence the name CENTRAFIRE.

The simplicity of Centrafire's hydraulic system is indicated in its control panel. The panel may be incorporated in the boiler control panel, if desired.

Diagram of single-source hydraulic drive—the backbone of Centrafire's high operational efficiency at all loads.



CENTRAFIRE

Load-Controlled Combustion Achieves *New Economy*

Get top economy in all phases of a varying load with Centrafire—the new Westinghouse Spreader-Type Stoker. The savings will show in your coal bill—not alone in test runs, but dependably in operation year in and year out.

Automatic synchronous operation of all parts, by means of a single-source hydraulic drive—enables the Centrafire to accurately proportion coal feed to air supply. No matter how many hours your load is at its low point, or how much it varies during peak periods, Centrafire balances fuel and air to meet the demand. Moreover, Centrafire burns any grade of bituminous coal or lignite, with top efficiency and economy.

The Westinghouse Link-Grate, automatically controlled by the same hydraulic source, gradually moves fuel—with a continuous wave-like motion—toward discharge grates at the sides. This keeps the fuel bed uniform, porous, and quickly responsive to changes in load. The discharge grates aerate the accumulating refuse to provide for full combustion; then cleave off the burned-out refuse, without affecting the fire, the fuel feed, or the load on the boiler.

The Centrafire with Link-Grate—the only really new idea in stoker firing equipment in ten years—meets industrial and public utility demands in the 25 to 50 thousand lbs. per hour range. It is backed by over 60 years of Westinghouse stoker design and manufacturing experience, and a nationwide service organization maintained to see that your operators get—and continue to get—top combustion performance. J-50501

GET THE FACTS...

It will pay you to get the full story on Centrafire. Ask your Westinghouse representative for this 16-page illustrated booklet, B-5890, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

Westinghouse

STOKERS

Want to cut Maintenance Costs?

Byers Wrought Iron

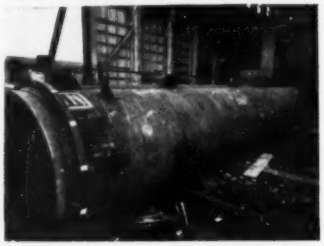
PLATES and BARS

can help

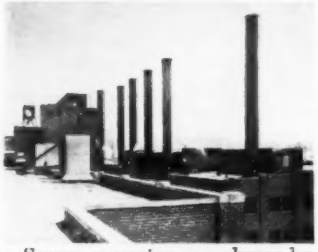
Even a minor repair is expensive today, and any major replacement is a serious drain on profits. The only sure protection against this waste is the use of a *durable* material, that will give the longest trouble-free life.

Byers Wrought Iron pipe has been an invaluable aid to engineers in combating corrosion, and so reducing repairs and replacements in pipe lines. The same proven corrosion resistance helps to solve maintenance problems in applications where plates or bars are used. A few of the many installations where Byers Wrought Iron hot rolled products are successfully serving are shown here. These may suggest places where you could profitably use wrought iron.

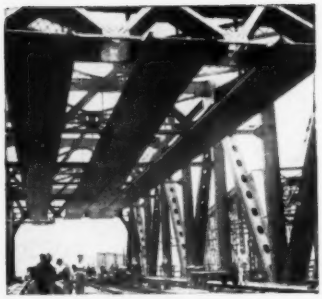
The difficulty and the cost of repairs to elevated tanks and standpipes makes durability a prime requirement. Wrought iron's record certifies its longer life. One elevated tank was recently torn down, after 62 years of continuous service, during which it was exposed not only to internal corrosion, but to salt air from the ocean, a short distance away. Several municipalities have water towers of wrought iron still in service after 50 years or more, which have received no maintenance beyond an occasional painting.



In large underground lines like the one illustrated, Byers Wrought Iron helps to guard against premature failures and excessive repairs. In one municipality, for instance, a 50" wrought iron water line is still serving after 60 years. Only one leak has ever been reported, although operating pressure is 135 pounds.



Severe corrosion can always be expected in unlined metal stacks, and changes in fuels, addition of economizers or draft inducers, or other factors may aggravate the condition at any time. Wrought iron has made an impressive record in this service. Users who have made comparative tests have reported up to four times the service from wrought iron.



Blast gases from locomotives quickly weaken ordinary structural members. Wrought iron blast plates provide needed protection. In one historic installation, wrought iron served for over 60 years before replacement.

Hulls of work boats operating in salt, brackish or polluted waters must take a severe beating. Wrought iron has proven itself in this gruelling service. A number of ships with wrought iron hulls are reported as still serving after half a century or more.

If you have any corrosive application where ordinary flat rolled materials do not stand up, you'll find it profitable to investigate the service record of wrought iron. The nearest District Office will be glad to give you a technical bulletin, or detailed information on request.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N.Y.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS

GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

POWER

PHILIP W SWAIN, EDITOR • AUGUST 1949 • ESTABLISHED IN 1882

Smoke and Dust Confusion

ADMITTING WHAT WE DON'T KNOW is the beginning of wisdom, so let's face up to the existing confusion about ways to curb smoke and dust from power-plant stacks.

This editorial is not intended to be critical of anybody in particular, for the confusion is general and includes all of us engineers. It's safe to say that nobody has yet found a really first-class answer to this national problem.

We don't even understand the health angle. Much has been published about smoke as a menace to health. Yet no less an authority than Dr A J Lanza (chairman, Council of Industrial Health, American Medical Association) says of smoke, "That it can cause specific diseases or death to any considerable degree cannot be stated in the light of available evidence."

Hard to believe, but there it is, and we hope the MDs will get busy and pin down the facts on this, whatever they are. Meanwhile, from the plain nuisance angle, we know that modern communities won't continue to tolerate the present levels of stack smoke and dust.

We also know that any city that sets out on a white horse with a brass band to clean up all the dust and smoke will change its tune when the human and dollar costs are known.

It's better to succeed moderately in a reasonable smoke and dust program than to attempt the impossible and accomplish nothing.

Well, what is practicable? Many communities have had fair success in reducing visible smoke by simple old-line rules based on the Ringlemann chart. The Ringlemann chart may be old fashioned and unscientific, but politically it is the most practical smoke-prevention device ever invented because it is cheap, requires no costly testing, and labels the offender for all to see.

Stopping dust is a very different matter. Mostly you can't see it until it lands on your laundry. Then you can't prove who made it. Ordinances specifying how much dust a stack may discharge per thousand pounds of flue gas probably have value for the few large utility and industrial plants that can bear the burden of the costly dust sampling. As far as the smaller plants are concerned it is certain that such ordinances will become dead letters, "noble experiments," if they mean actually measuring dust emitted by suspected violators. If anybody thinks communities will stand the cost of such small-plant dust tests as a routine matter let him get the opinion of practical smoke inspectors.

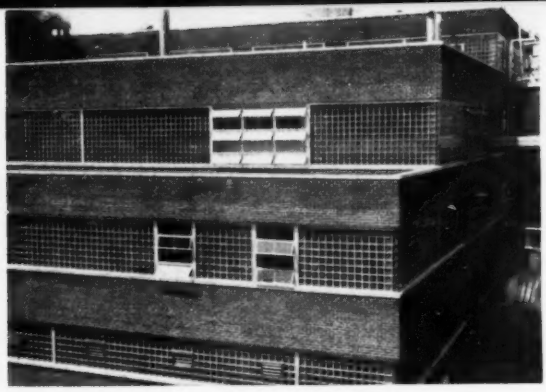
Also remember that a large proportion of existing coal-burning installations could not meet the suggested ASME limitation of 0.85 lb dust per 1000 lb of flue gas. Any serious proposal that this be enforced on a community-wide basis, for all plants, large and small, should face the fact that most plants would be forced to install dust collectors.

Perhaps the best answer to dust emission by small plants will be in the setting up of certain minimum equipment and fuel standards, including the requirement of dust collectors for certain fuels and firing methods in specified zones of the community.

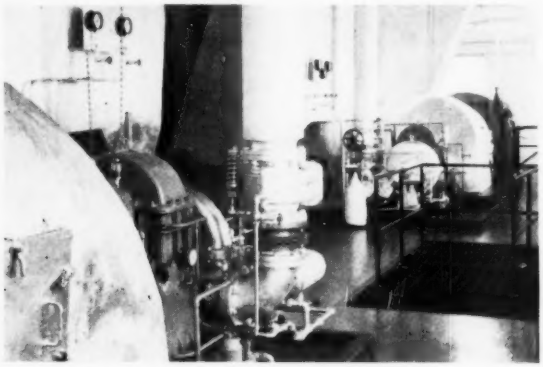
Even this is not what you might call a happy solution. There aren't any such in this field. You just take your choice among the available evils.

The whole problem of power-stack smoke and dust is so important that POWER will welcome comments from combustion engineers and smoke-inspection authorities.

1 Modern power plant on Thames River has 139-ft buff-colored stack and front panels, red brick and glass-block walls



2 Large areas of glass blocks at each floor level permit inside of plant, Fig. 3, to enjoy benefits of full daylight



5 Close adjustment of heat-balance results from some auxiliaries like the dual-drive fans using steam or motor drive

Plenty of Power Capacity in Advance

Charles Pfizer & Co reasons that process growth can move only as long as the power services feed it. So its new Groton, Conn. plant gets under way with first things first—a large-sized power plant closely integrated for small-shift operation

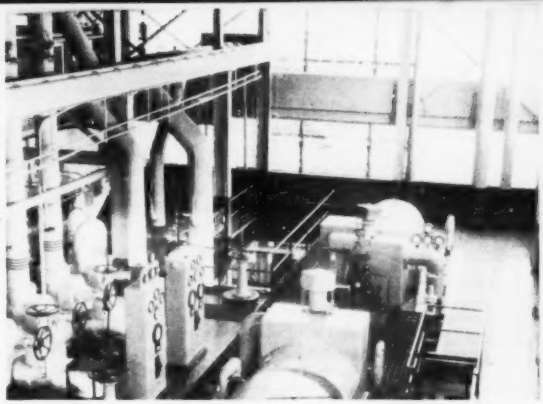
► When Charles Pfizer & Co, Inc located its new plant at Groton, Conn., its 100 years of experience and growth in chemical and pharmaceutical manufacture suggested providing ample power to meet any foreseeable expansion. Adequate steam, electric and compressed-air generating facilities were felt necessary to process growth. In addition, the new power plant should be so designed that it could run with a 3-man shift under normal conditions. Both aims are realized in the new plant.

The site on the Thames River is 60 acres. Formerly used as a submarine building yard, it had the nucleus of an excellent power-service distribution. Underground water mains, fire-protection lines and 2300-v electrical feeders were already in. There were good roads, docks and railroad sidings. But the only steam supply was for heating load only.

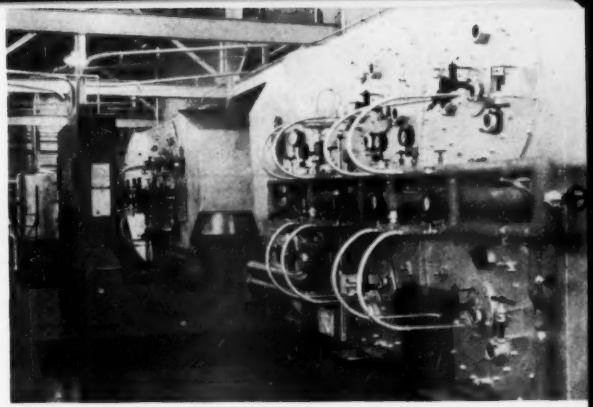
With an underground power-service system on hand considerable thought was given to locating the power plant. This new plant, Fig. 1, uses existing facilities to full advantage and yet is centrally located for an expected manufacturing growth to the south. Moreover, if coal becomes the future fuel an unloading pier for barges, plus sidings for railroad cars, is already available. Space has been set aside for concrete storage silos whenever they are needed.

Right now the only fuel is oil. Two 24,000-gal storage tanks in concrete-enclosed fire walls and five already existing 10,000-gal underground tanks hold the oil supply. A transfer pump house takes oil from tank cars or trucks and delivers it to storage. Until the time the plant load builds up to where a decision between full-scale coal or oil operation is made, this system will be kept.

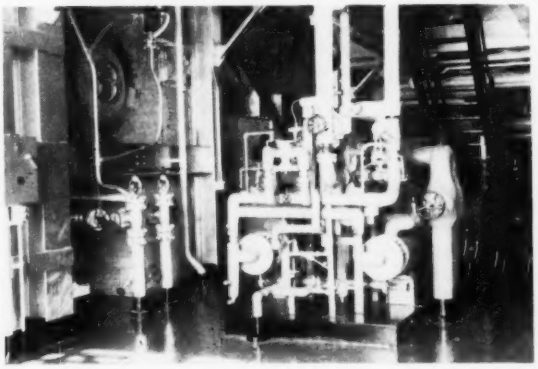
Power Plant. Since the power plant is right near the mouth of the Thames River and the eastern end of Long Island Sound, steps had to be taken against



3 Absence of a separating wall between the turbine and boiler rooms, left, makes for easier operation, a cleaner plant



4 Firing aisle faces turbine room, Fig. 3; 115,000-lb-per-hr boilers while at low load use steam-atomizing burners



6 Good fuel-oil preheater system assures that oil reaching burners is at proper viscosity for smoke-free combustion

7 Ventilators, in pairs, mount in the building roof over each steam generator to cool and help keep that area clean

Permits Process to Grow on Demand

possible flooding. There is no underground basement or pit. Instead, the building has an elevated foundation. The floor, for ash handling, boiler feed pumps, desuperheating stations and future pulverizers, stands two feet above the highest water level recorded during the 1938 hurricane. Fourteen feet above this level comes the main operating floor.

The power-plant building is of modern and attractive design, Fig. 1. All building walls are red brick except the front and south walls. The south end has a bolted-steel-work construction with terra-cotta blocks for easy removal whenever a future power-plant expansion is required. The building front, on the west elevation, has panels of buff-colored face brick. These panels connect to and carry down the buff color of the 139-ft stack, which stands on the power-plant roof. This stack, incidentally, is lighted up at night to form a land mark along the river.

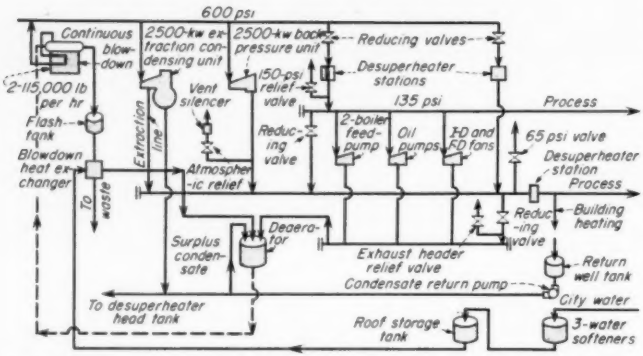
Large glass-block areas, Fig. 2, in horizontal panels at waist height on each of the four floor levels (1) add to the building appearance (2) make the interior a brightly lighted, cheerful working space. Stainless-steel louvers, which serve as inlets for the forced-draft fans, align with the glass-block panel on the third-floor building front. These adjustable louvers permit a free intake of air at this level without detracting from the building exteriors.

Mounted in the building roof above the top of the boilers are two sets of ventilators, Fig. 7, one pair above each boiler. These ventilators (a pair in parallel to one set) are aluminum, about 15 ft long by 3 ft wide, and stand about 4 ft above the roof level. Air travels through them under the control of adjustable baffles. These ventilators relieve the usual high-temperature area above the boilers. Further, they promote air movement in this region so plant dust does not build up.

A selection of light-colored paints applied to the building interior carries the bright, clean look to the inside. Turbines, switchboard panels and side walls are painted a vista green. Concrete floors are gray dado and tile red in color. All hand rails, valve wheels, meter rims have a black paint. There is no separating wall between turbine room and boiler room.

Power Cycle. Two 115,000-lb-per-hr steam generators, Fig. 4, deliver steam at 735 F to a 600-psi header, Fig. 8. Two 2500-kw turbine-generators, Fig. 3, one a condensing-extraction unit and the second a backpressure design, take steam from this header. In addition, two reducing and desuperheating stations tie into the header. One of these

CHOICE OF DRIVES HELPS HEAT BALANCE



8 Diagram shows how electrical and steam demands, plus loads at different process levels, are balanced by reducing stations, condensing and backpressure turbines

stations reduces steam to 135 psi for evactors and steam pumps in process and for power-plant auxiliary drives. The second feeds into the main process header at 50 psi where it mixes with the extraction from the condensing unit and exhaust from the 2500-kw backpressure turbine-generator.

Each of these pressure-reducing stations is equipped with spring-loaded relief valves. Their presence protects any installed equipment that would be damaged by an overpressure on the supply header. With process load still growing, highly variable pressure fluctuations can develop on these headers so such protection gives good operating safeguards.

Since the 50-psi header supplies the bulk of plant-process needs an additional source of supply comes off the 135-psi header through a reducing valve. Of even more importance during the early light-load periods it allows the 600-135 psi reducing station to operate at ratings above those where the pressure-reducing station valve might suffer from "wire drawing."

Exhaust steam from all power-plant auxiliaries operating off the 135-psi header goes to a 5-psi header to join with the steam output of a 50-5 psi reducing valve. This 5-psi header heats up the 230,000-lb-per-hr feedwater deaerating heater.

Most process steam comes off the 50-psi header. In the winter, plant heating, including offices, also draws from this same header. The 2500-kw backpressure turbine-generator, which exhausts at 50 psi into this header, has a spring-loaded relief valve in its exhaust line in series with a silencer. Temporary oversupplies of steam entering this header result in turbine exhaust bleeding off through this relief valve and venting to atmosphere. The silencer prevents this exhaust from becoming a noise nuisance.

Water Cycle. Power-plant heat balance was originally drawn up on the basis of no condensate return from process. At the present time some condensate is returning but provisions exist for handling it. Whatever condensate comes back, including that from unit heaters or convectors in the building heating system, enters a return well tank. Condensate-return pumps draw water from this tank and deliver it along with condensate from the 2500-kw condensing turbine-generator to the desuperheating and reducing stations. Any condensate, over and above the desuperheating station needs, dumps into the deaerating feedwater heater. A conductivity meter watches over the condensate from the condensing turbine to warn against any salt leaks.

All makeup comes from treated city water. This water enters three zeolite water softeners and goes from there to a roof storage tank. It is pumped from this point through the continuous boiler blowdown heat exchanger to the deaerating heater. Boiler feed pumps, steam driven from the 135-psi header under the control of excess-pressure regulators, supply the individual steam generators.

Supplementary water treatment consists of phosphate and caustic feeders, plus an after treatment in the steam lines. A portable water-testing unit set up in the boiler room provides a small laboratory for the water tender.

Operating Features. Some of the major boiler auxiliaries are steam or motor driven. Such an arrangement enables a close adjustment of heat balance for any changes in plant loading. Forced- and induced-draft fans, Fig. 5, mount on a single shaft, with turbines and overdrive on the one end and synchronous motors on the other.

The tubular air preheater has a recirculating-air connection. This draws off by baffling a portion of already heated air and recirculates it to the cold-air inlet. The result is to raise the average inlet-air temperatures. This increase in inlet-air temperature helps keep the exit flue gas from reaching dewpoint temperature and causing corrosion and tube plugging at the exit end of the air preheater.

A pneumatic ash-removal system had been installed against a future shift to coal burning, and to remove petroleum ash now settling out because of light loading. There are ash-removal connections in the last pass of the boilers and at the base of the stack. From here all removed material goes to a tile silo outside the plant. Spacer pieces have been set in the ducts for future flyash collectors.

Before starting up with the present light load the mechanical atomizing oil-burners originally specified were replaced with steam-atomizing burners. Continued operation at low loads makes the steam units more economical of oil.

While this low-load period continues the plant is operating at other than design conditions. As any plant operator knows this calls for special procedures and better-than-average operating skill. The Pfizer management foresaw and met this situation by setting up a training school for new engineers, firemen and water tenders. There they had an opportunity to study the plant equipment and follow it up by checking pipelines and valves as the plant was constructed. This schooling has paid off in good operation.

Salt-Water Cycle. Two vertical-mounted salt-water pumps mount on the pier within a screened enclosure. They provide salt water for (1) process cooling (2) turbine-condenser unit. A chlorinator controls growth of mussels in the piping and prevents algae growth.

General building work was performed by the W J Barney Corp of New York City, electrical contractor was Ealahan Electric Co of New London. Champion Construction Co erected the boilers; Clayburn Contracting Co furnished and installed the boiler brickwork. All field work was supervised by the Pfizer engineering department under D C McClain, director of engineering. Baker & Spencer, New York City, prepared the designs, reporting to W R Townsend, chief engineer of the owner's Brooklyn engineering department.

PRINCIPAL EQUIPMENT IN POWER PLANT

Charles Pfizer & Co, Inc, Groton, Conn.

STEAM GENERATION:

Steam generators, 2 ..... Combustion Engrg-Superheater, Inc
VU type, 115,000 lb per hr, 675 psi, 750 F, oil fired
Superheaters, 2, 1 each per boiler .. Combustion Engrg-Superheater, Inc
Interbank, 900 sq ft, final steam temperature 750 F
Soot blowers ..... Diamond Power Spec Corp
Air heaters, 2 ..... Combustion Engrg-Superheater, Inc
1 each per boiler, tubular, air recirculation
Burners, 8, 4 per boiler, wide range, mechanical ..... Peabody Engrg Co
Burners, 8, 4 per boiler, steam atomizing ..... Peabody Engrg Co
Combustion control ..... Bailey Meter Co
Flyash collector, 2 (for later installation) ..... Flyash Arrestor Corp
Two-stage, Whirlex, 70,000 cfm, flue gas at 380 F
Breechings, boiler ..... Electric Boat Co
Blowdown, continuous ..... Permutit Co
27,600 lb per hr blowoff, from 630-5 psi
Blowdown flash tank ..... Permutit Co
54-in. dia x 5 ft, 50-psig working pressure
Level indicators ..... Yarnall-Waring Co
Fans, forced, 2, 1 per boiler ..... American Blower Corp
Vane controlled, 30,000 cfm at 100 F, dual drive
Fans, induced, 2, 1 per boiler ..... American Blower Corp
Louver-control, 60,000 cfm at 380 F, dual drive
Fan, turbine drive, 2, 1 per fan unit ..... Elliott Co
Overriding clutch, 125-psi supply steam, 7-psi exhaust
Fan, motor drive, 2 ..... General Electric Co
200 hp, 900 rpm, 2300 v
Fuel-oil preheater set ..... Peabody Engrg Co
Fuel-oil pumps, 2, 19.5 gpm, 300 psi ..... DeLaval Steam Turbine Co
Turbine drive for above ..... Carling Turbine Blower Corp
Motor drive for above ..... Electric Dynamotor Co
Fuel-oil heater, steam heated ..... Davis Engineering Co
Oil-supply tank heaters, 2 ..... Griscom-Russell Co
Day-supply tanks, steam heated
Chimney, radial-brick, 1 ..... M W Kellogg Co
7-ft dia inside at top—139 ft above roof top
Lightning arrester, chimney mounted ..... M W Kellogg Co

PUMPS AND WATER TREATMENT:

Boiler feed, 2 ..... Ingersoll Rand Co
250 gpm at 225 F, 1850-ft head
Boiler-feed turbine drive, 2 ..... Elliott Co
Regulators, boiler feed, 15,000-125,000 lb per hr ..... Stets Co
Deaerator, one, 230,000 lb per hr ..... Cochrane Corp
5-psig operating pressure, 50-psig vent condenser
Water softener, 3 ..... Permutit Co
Zeolite-type, 795,000 gal per 24 hr, 8-ft dia x 6-ft height
Salt tank, 1, 3-ft dia x 4-ft height ..... Permutit Co
Zeolite regeneration
Chemical feed tanks, 4 ..... Turbine Equipment Co
1 phosphate, 1 aux, 2 sulphite and caustic
Chemical feed pumps, 5 ..... Milton Roy Pump Co
2 carbon-steel bodies, stainless trim and piston
3 cast-iron body, stainless-steel seats, chrome-plated pistons
Desuperheater pumps, 2 ..... Turbine pump dept, Fairbanks, Morse & Co
Motor drive for above ..... Louis Allis Co
Compressor, 1 ..... Worthington P & M Co
Air-King, 2 stage, 29.9 cfm, 100-psig discharge
Heater, hot water, 1 ..... American District Steam Co
House service, 30x72 in., 220 gal
Ejector, sewage, 1 compressed air operated .... Blackburn-Smith Mfg Co
Duplex unit, 50 gpm for each of two pots
Chlorinator, salt water ..... Wallace & Tiernan Co
Water-treatment system ..... National Aluminate Co
Service pumps, treated water, transfer, 2 ..... Lawrence P & E Co
Raw-water transfer
Motor-drives for above ..... Century Electric Motor Co
Service pumps, brine, water softener ..... Lawrence M & P
Motor drive ..... General Electric Co
Condensate, transfer pumps ..... Deming Co
Vertical motor drive ..... U. S. Elec Motors Co

TANKS:

Feedwater storage, 1, 11,000 gal ..... Mayer Tank Co
Wood-stave, drum-head, 12 ft 6 in. dia x 13 ft depth
Raw water, 1, 22,500 gal ..... Electric Boat Co
Steel, 15-ft dia x 18-ft height
Fuel oil, 2, 22,500 gal ..... Electric Boat Co
Steel, 15-ft dia x 18-ft height
Desuperheater head, one, 300 gal ..... Nazareth Steel Fabricators, Inc
Condensate, 1 ..... Buffalo Tank Corp
Steel, 7-ft OD x 4 ft 9 in.

VALVES, PIPING & CONTROLS:

Regulating valves ..... D'Este Div, Reading, Pratt & Cady Co
Deaerator live-steam, 50 to 5 psig
Relief valve, 135-psi main ..... Atwood & Morrill Co
Relief valve, 50-psi main ..... Atwood & Morrill Co
Relief valve, exhaust heater, opens at 7 psig ..... Cochrane Corp
14 in. multiport, 50,000 lb per hr
Relief valve, cooling-water line, normally closed ..... Davis Engrg Co
Relief valve, desuperheater pumps ..... J. E. Lonergan Co
Liquid level, raw-water storage ..... Kieley & Mueller Co
Liquid level, treated-water storage ..... Fisher Governor Co
Desuperheater head tank, Brine tank, Condensate tank ..... Davis Engineering Co
Piping, prefabricated and high pressure ..... W. K. Mitchell & Co, Inc
Piping, general ..... J H Merritt Co
Pipe covering ..... R A Keasbey Co
Desuperheater & pressure reducing, 3 ..... Republic Flow Meters Co
One 635 psi—50 psi, 100,000 lb per hr
One 625 psi—135 psi, 50,000 lb per hr
One 50 psi—50 psi—process desuperheater station
Pressure reducing, 1, low-press .... D'Este Div, Reading Pratt & Cady Co
Exhaust silencer, 50-psi vent ..... Maxim Silencer Co
Ash-handling system ..... National Conveyor Co

METERS AND INSTRUMENTS:

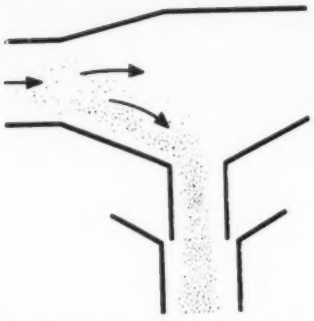
Smoke control, 2, 1 per boiler ..... Photoswitch, Inc
Pressure gages ..... Crosby Steam Gage & Valve Co
Pressure gages, recording ..... Bailey Meter Co
Thermometers, indicating ..... C J Tagliabue Mfg Co
Thermometers, recording ..... Bailey Meter Co
Conductivity recorder ..... Leeds & Northrup
Draft gages ..... Bailey Meter Co
Boiler-instrument panel ..... Bailey Meter Co
Flowmeters ..... Bailey Meter Co, Republic Flow Meters Co
Level indicators, boiler water, deaerator ..... Yarnall-Waring Co

ELECTRIC GENERATION AND AUXILIARIES:

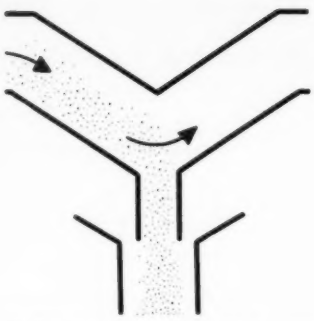
Turbine-generator, 1, 2500-kw, extraction ..... General Electric Co
Condensing, 525 psi, throttle, 2-in. Hg, 14 stages
Turbine-generator, 1, 2500-kw noncondensing ..... General Electric Co
525 psi, throttle, 50-psi backpressure, 11 stages
Condenser, 1, 2100 sq ft, two-pass ..... Allis-Chalmers Mfg Co
Admiralty tubes, Muntz tube sheets
Circulating pumps, 2, 1160 rpm ..... Pomona Pump Co
1—3200 gpm, 140 ft; 1—2000 gpm, 190 ft
Motor drive for above ..... Fairbanks, Morse & Co
Hotwell pump, 1, 2-stage, 90 gpm ..... Allis-Chalmers Mfg Co
Ejector, air, twin, 2-stage ..... Croll-Reynolds Mfg Co
Oil coolers, 2, 40 sq ft ..... Schutte Koerting Co
Air coolers, 2, 9000 cfm ..... General Electric Co
Oil filters ..... W W Nugent Co
Oil strainers ..... Elliott Co
Heat exchanger, 1, cooling water ..... Lummus Co
270 gpm of fresh water, cooled from 88 to 80 F, using 360 gpm of salt water at 60 F
Pumps, vacuum ..... Nash Engineering Co
Switchboards ..... Westinghouse Elec Corp
Meters, relays ..... Westinghouse Elec Corp
Frequency meter ..... Leeds & Northrup Co

CONSULTING ENGINEERS:

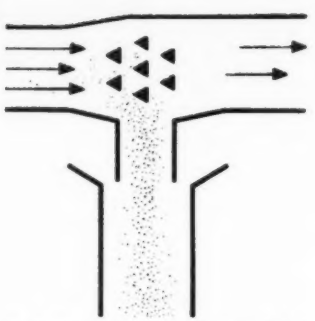
Design ..... Baker & Spencer, Inc
Construction and contracting ..... W J Barney Corp
Engineering Dept supervision ..... Charles Pfizer & Co, Inc



1 Just a sudden change in gas velocity causes heavy particles to fall out



2 Changing the direction of the gas stream throws heavier particles out



3 Particles impinge against small baffles in the gas path and fall out

What Plant Operators Need to Know

New smoke ordinances regulate dust loading of flue gas within such close limits that every power-plant man has to know where his plant stands. Here's basic practical data on flue dust: its properties, formation and methods of control

By L N ROWLEY, *Executive Editor*, and J C McCABE, *Associate Editor*

► SUPPOSE YOU'VE DONE a good job of matching fuel, firing equipment and furnaces in your plant. You insist on, and get, topnotch operation. Combustion is efficient and complete. Can you sit back and figure you've done your bit in the fight for clean air? Maybe, if you're lucky, but usually the answer is "No." Here's why.

Boiler-plant stacks may spill out a number of things that pollute the air. Some of them can be licked right at the start—smoke, for instance. Broadly speaking, smoke consists of combustion products that didn't finish burning, mostly carbon. These are so finely divided that we can see them only in a mass. The more complete the burning job in the furnace, the less smoke. Past articles in this series show how to insure the complete combustion needed.

Dust Emission. But dust is another breed of cat. Most common fuels contain some mineral matter, or ash, which does not burn. For all practical purposes, there is none in gas, only a little in oil. But coal rarely contains less than 5%, and may carry 20-30% or more. No matter how good a burning job we do, this mineral matter remains. Along with it we usually get some unburned carbon—not the almost microscopic particles that form smoke, but particles large enough to see and feel. The resulting mixture is *flyash* or *cinder*. There isn't any hard and fast dividing line between them. We usually call larger particles cinder and smaller ones flyash. Let's simplify it by speaking here of "dust."

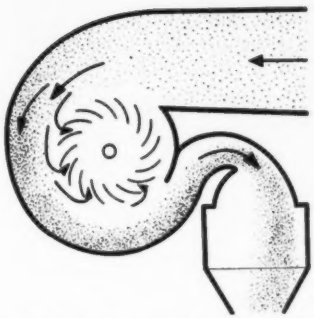
Besides differing from smoke in particle size, dust differs also in that we can't avoid making it. But we can do something about spilling it out of the stack. To begin with, some of it takes care of itself. Depending on the fuel and the firing method, some ash and unburned carbon goes to ashpit.

It's the part that gets out of the furnace that concerns us here. Some of it will fall by the wayside in boiler passes and breechings, but most of it heads for the stack as a potential nuisance. How much starts along this route depends to some extent on the fuel, perhaps even more on the firing method and kind of operation. Let's see how.

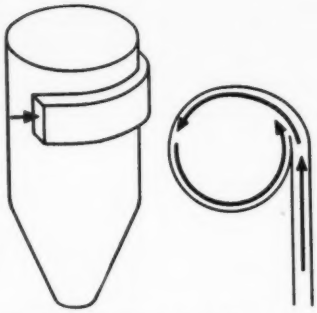
Stoker Dusts. With true fuel-bed firing—underfeed and traveling-grate stokers—we start with the ash where it belongs—on the grate. It's the air flow through the fuel bed that does the dirty work. The heavier the draft, the more ash and carbon particles will be lifted off the bed and into the furnace gas stream. We can see right away that the type of coal comes into the picture. A high percentage of fines tends to increase carryover; caking or clinkering tends to cut it down.

Burning Rate. Perhaps most important of all is the burning rate. High burning rates mean high drafts, more tendency to lift small particles off the fuel bed. It is probably safe to say that with conservative burning rates—say, 25 lb per sq ft or less—and all but high-ash fuels, the average underfeed or traveling-grate unit will not throw out enough dust to create a legal nuisance in most communities. But as the burning rate goes up, dust emission increases rapidly.

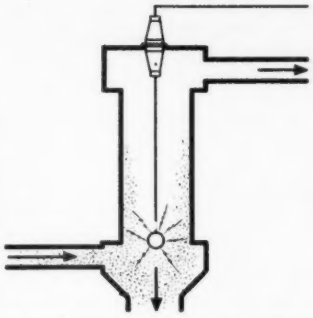
Combining as it does both fuel-bed and suspension firing, the spreader stoker behaves differently. Instead of starting life on the grate, all ash par-



4 Fan adds centrifugal force to pull out particles, skimmer collects them

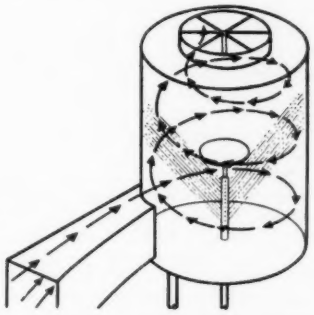


5 Cyclone uses centrifugal force in a tight circle; removes small particles



6 Electrostatic collector puts charge on small particles; draws them from gas

About Flue Dust



7 Gas passing through water stream has both the solids and fumes washed out

ticles are in suspension first. Some fall to the grate, but the setup tends to favor their staying in suspension and being carried out of the furnace. This difference in firing method produces two practical results: (1) average dust carryover is likely to be higher than with true fuel-bed firing, and (2) the effect of burning rate is greatly reduced. This means dust carryover for spreaders runs almost the same at high firing rates as at low ones, whereas, for underfeeds, it may be five times as great at top burning rates as at low.

Here, too, fuel selection and good operation can reduce dust emission somewhat. Coal with a lower percentage of fines undoubtedly helps, and so may larger top size. Proper application of overfire jets may be beneficial.

Pulverized Coal. With true suspension firing—pulverized coal—we come to the most severe dust problem. Where underfeeds and traveling grates may deliver roughly 15% of the ash in the coal to the flue gas, at normal burning rates, and spreaders may deliver 20-25% or more, pulverized-coal firing runs in the range of 40-70%. Slag-tap furnaces usually show dust loadings toward the lower end of this range, dry bottoms toward the upper.

Having seen something of how dust emission varies with firing methods, and what good operation can do to cut it down, we're ready for the big question. What amount of dust makes a nuisance and what can we do about it? As we'll see later, stack height, location, the surrounding terrain, etc, affect the course of the dust after it leaves the stack and so have a lot to do with how annoying it is. Yet where air-pollution ordinances set limits on dust emission, and more and more of them do, such factors are rarely included.

Dust Limits. The usual ordinance merely sets a limit on the *dust loading* —that is, the amount of dust in a given amount of flue gas. This may be expressed as grains of dust per cu ft of flue gas, or lb of dust per M lb of flue gas. For example, the Pittsburgh ordinance sets the limit at 0.75 gr per cu ft at 500 F. The Philadelphia ordinance puts it at 0.85 lb per M lb and an ASME committee uses the same figure.

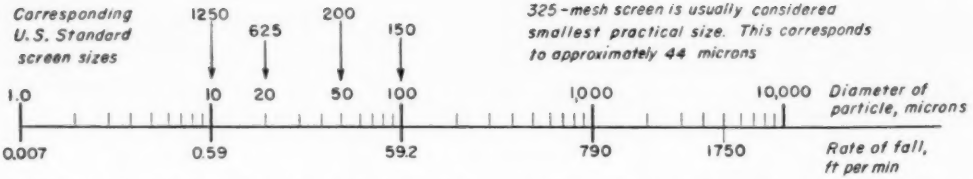
How Much Dust? To see what this means in practice, let's assume we're burning bituminous coal running 8% ash as fired. Let's also assume that our stoker delivers about 15% of this ash to the flue gas, not an unreasonable figure for an underfeed, say, at about a 25-30 lb burning rate. To simplify the figuring, we'll ignore any carryover of carbon. This works out to about 12 lb of dust per 1000 lb of coal fired.

Rough figuring tells us that with about 30% excess air we'll get approximately 14,000 lb of flue gas per 1000 lb of coal. Thus we have a dust loading of 0.86 lb per M lb of flue gas, right on the ragged edge of the limit set by many of the recent ordinances, 0.85 lb per M lb. While this calculation is rough, it's good enough to show that, under such ordinances, virtually all plants would be potential offenders except, possibly, underfeed or traveling-grate units burning low-ash coals at conservative ratings. To avoid violating the ordinance some form of collector is necessary to catch the dust we can't avoid putting into the flue-gas stream.

Fortunately, there are a great many ways of collecting dust. Some collectors catch a higher percentage of it than others. Some are more expensive than others. They also differ in space required, and in the draft loss they add. The job of the power engineer is to select the unit that most nearly meets his plant needs. This requires some knowledge of the principles on which collectors work, and of the nature and behavior of dust particles. Let's first take a look at collection methods.

Dust Removal. Fig. 1-7 show basic principles on which dust collectors work. Simplest of all is Fig. 1. Here we have a wide space in the duct or breeching. The gas slows down and gives the heavier dust particles a chance to settle out. In Fig. 2, the gas stream goes around a bend. Inertia makes the heavier particles tend to keep going in the old direction, works with gravity to throw them out of the stream. Such devices are often called dust traps, or cinder traps.

Fig. 3 shows the impingement type of collector. As dust-laden gas stream



8 Micron sizes, rates of fall, and U.S. standard screen sizes are compared above, important in reporting flue dust size.

Selecting the right collector for an individual plant requires a knowledge of size consist of flue-dust particles

enters the enlarged low-velocity section, baffles either interrupt the flow or change its direction, helping the particles to drop out.

Centrifugal force may also be used to separate dust particles from the gas. Flow must be speeded up, so an induced-draft fan is required. In Fig. 4 the fan itself does the collecting job. Reversing vanes ahead of the rotor divert gas into rotor and dust toward a skimmer or "shaveoff." The dust, along with a small amount of gas, enters a secondary separator.

Cyclone Collectors. The cyclone is a familiar device, widely used for separating solid particles from air or gas. As shown in Fig. 5, dust-laden gas enters a cylindrical chamber on a tangent. Whirling action sets up centrifugal force that throws dust particles to the outside. Early cyclones had relatively large diameters. Research showed that making the gas travel in a tighter circle boosted efficiency. Thus modern units usually consist of a number of cyclones of relatively small diameter, sometimes as little as 3 in.

Collecting devices of Fig. 1-5 all work by using mechanical force to separate the dust from the gas. Since the weight of the particle is involved, these units tend to collect larger particles more effectively than smaller ones. Stepping up the force applied, as in the centrifugal units, helps to pull out the finer particles.

Electrostatic Collector. In contrast, the device in Fig. 6 uses an electrical charge to pull out the dust particles and works best on fines. In principle, electrodes at high dc voltage impart charge to passing dust particles. This causes them to be attracted to collecting electrodes having an opposite charge. Once out of the gas stream and on the collectors, the dust can be dislodged by any of a number of rapping devices. Such units are called electrostatic precipitators. They are most widely used on pulverized-coal fired units.

Gas Scrubbers. Flue dust can also be taken out of flue gas by washing. This scrubbing action does more than just remove solids; it also absorbs sulphur gases, which may be important sometimes. In Fig. 7, dust-laden gas enters a cylinder tangentially and spirals to the top. A water manifold in the center supplies the spray. While extensively used for cleaning gases coming off industrial processes, scrubbers have not found wide use on boilers in this country.

Thus it can be seen that there is a form of collecting device to meet almost any need. In following articles we will describe the construction details of equipment available commercially and take a closer look at their operating characteristics. Right now, let's go back to dust itself and find out a little more about its nature and behavior. We'll need this information to compare collector types intelligently.

Particle Size. Size of dust particles is commonly expressed in *microns*. A 1-micron particle would be 1/1000 millimeter, or 1/25,400 in. in diameter. Some idea of what this means can be gained from the fact that particles just passing a 325-mesh U. S. standard screen would measure approximately 44 microns. A 10-micron particle can barely be seen by the naked eye. The particles we're concerned with here may range from about 1 micron to 150, or higher. For comparison, smoke particles range from about 0.001 to 0.3 micron. In the range between, 0.3 to 1.0 microns, we have what are usually called "fumes."

Rate of Fall. There's a slight catch in this particle-size business, though. The only practical way of measuring extremely small particles is by seeing how fast they fall in still air. Let's say that a group of particles falls at a certain rate. If this corresponds to the rate of fall of solid spherical particles having diameters between, say, 10 and 20 microns, then the group of particles we're measuring is said to range from 10 to 20 microns. Actually, they will not all fall in this size range because they are irregular in shape and some may be hollow.

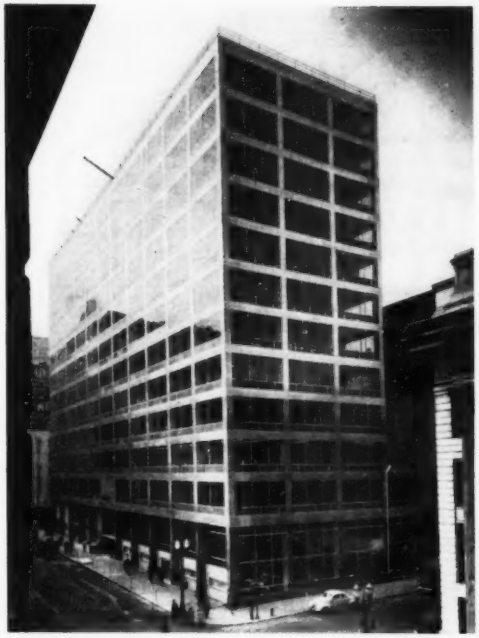
In practice, this difference, while good to know about, is not too important because in most dust-collecting equipment rate of fall is the critical factor. Fig. 8 gives a handy comparison of micron sizes, rates of fall and corresponding U. S. standard screen sizes.

Size Consist. Size of particles in flue gas depends on type of firing equipment and, to a lesser extent, on kind of coal and operating methods. For example, a single-retort underfeed may yield mostly large particles (75 microns or more) with only a sprinkling of fines. On the other hand, a pulverized-coal furnace may deliver mostly particles under 20 microns, with only a small percentage of larger ones. The proportions of the various sizes present in flue dust is summed up in the *size consist*. Knowledge of size consist is important in selecting a collector because, as we have seen, some types remove larger particles more effectively, while others do better on the fine ones.

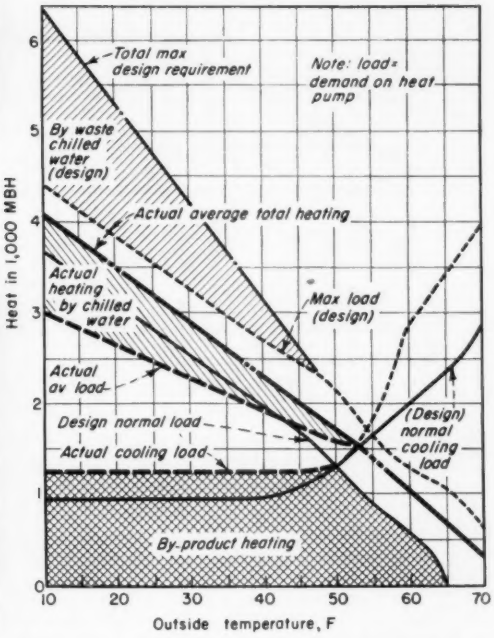
Efficiency. Dust-collector efficiency is measured by comparing weight of dust removed from a given quantity of flue gas with total amount present. Efficiencies should be definitely related to particle size distribution as commercially determined. With size distribution and gravity of dust known, over-all and expected efficiencies can be predicted by the manufacturer.

Chimney Effects. As mentioned before, present-day ordinances do not usually take stack height into account. Yet there is no reason why the plant designer anxious to reduce air-pollution problems should not avail himself of possibilities in this direction. While the problem is complicated by such factors as dust-size consist, local weather conditions and surrounding topography, what we want, in general, is to discharge the flue gas at the highest practical level. The higher this is, the greater the travel of dust particles and the greater the diffusion.

Careful study of data now available, on behavior of flue gas discharged from stacks, pays dividends. Taking these factors into account when designing a stack often leads to improvements in air-pollution conditions that are relatively economical to obtain. The point to remember is that stacks are as much waste-disposal equipment as they are draft producers.



1 Equitable Building in Portland, Ore, stands 200 ft high; all-aluminum clad; double-glazed column-to-column windows



2 Comparison between design loads based on hour-by-hour data and the actual 24-hr average shows in above curves

How the Largest Heat Pump Performs

Largest heat-pump installation in U. S. not only proved its economy in weathering the most severe winter in Portland, Ore. history, but did it without any auxiliary heat supply at all*

► BACK IN JANUARY 1948, the largest heat-pump installation in the U. S.—and one without any auxiliary heating source—went into operation in the new Equitable Savings & Loan office building in Portland, Ore. This installation has now completed a full winter's service. The winter, 1948-49, was, incidentally, one of the most rigorous in Portland, Ore. history, 4900 degree days against the previously-regarded-critical 1940 winter of 4100 degree days. Just how the equipment acted under such a test is important.

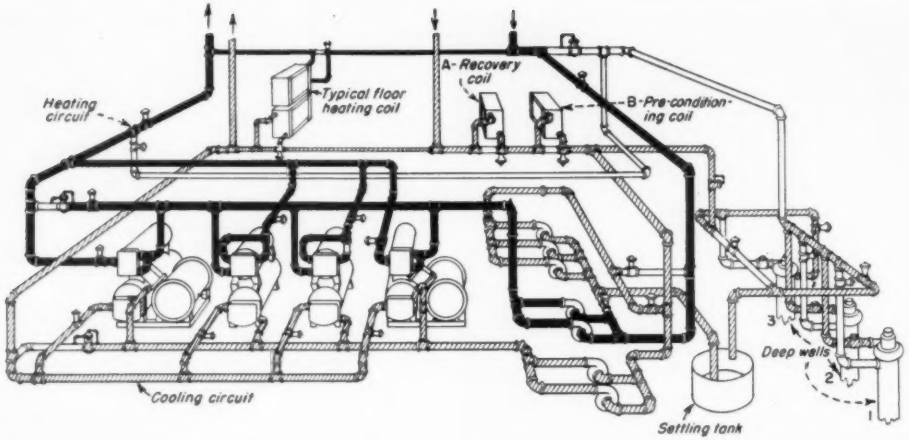
The installation serves a building, Fig. 1, with twelve stories of office space, two penthouse levels and a basement. From the outset complete air conditioning was decided upon. And when it came time to select and choose the method, two factors stood out: (1) Cooling load amounted to considerably more than heating load, Fig. 2. (2) Electrical energy costs looked relatively low, 7 mills per kwhr.

Costs. From a comparison of first costs for the different heating systems considered—purchased district steam vs a water-to-water heat pump—the heat pump proved to be economically feasible. Complete installed costs of the heat-pump system ran roughly $1250 per rated ton, or $0.29 per cu ft. Operating costs, as they were then estimated, definitely favored the heat pump. On the basis of (1) a coefficient of performance of 3.5, (2) a 7-mill-per-kwhr cost (3) a weighted value of waste chilled water: weighted to credit all heating from this medium, heat-pump costs were expected to be about $0.46 per million Btu.

What Happened. Predicted power consumption and power costs were based on weather data for 1940, a critical year with 4100 degree days, as already mentioned. The system was built around this critical data because so much dehumidification load was expected that hourly data were needed for cost analyses. Last winter exceeded 1940 as a critical year. It had 4900 degree days. Table I compares predicted and actual power requirements. (see Operating Experiences, p 81).

Certain sunless days were selected in determining complete heat balance so the pictured load is somewhat higher than normal. Temperatures were 24 hr average to allow for building lag in heat transmission. Actual total-heat input and output for the selected days make up Table II. A detailed comparison between design and actual conditions shows in Fig. 2. Biggest difference between the curves in this figure goes back to the data behind them. The predicted figures are instantaneous values and the actual are 24-hr averages. This accounts for the actual average load showing values so much

*Abstracted from (1) "A Heat Pump in an Office Building," presented before the American Society of Heating and Ventilating Engineers, New York, N. Y., Feb 1-3, 1948. (2) "Heat Pump Results in Equitable Building," presented before the same society, Minneapolis, Minn., June 1949.



3 Where heat load is greater heating circuit is closed. Hot water leaves condenser section of compressors, goes through heating coils on floors. Chilled water gets to cooling coils, picks up heat in exhaust air, *A*, warms up incoming air *B* saves heat

lower than predicted. And, in the same way, heat gained by (1) recovery from exhaust ventilation air (2) use of chilled water for preheat or preconditioning is lower than predicted.

Air-Conditioning System. Now let's look at the system as installed. The basic scheme hinges on the heat pump serving in both a cooling and a heating system. Here is why. The building is zoned according to exposure, interior areas and special zones. During some seasons of the year certain zones require cooling, some heating and others cooling and dehumidification, all at the same time.

Equipment centers, one on each floor, circulate conditioned air through ducts concealed in furred ceiling spaces. Air enters the occupied areas by 2-way, 3-way and 4-way diffusers mounted in the ceilings. Air returns, which may be exhausted or recirculated, come back through (1) a continuous grille on the window sill or small grilles near the floor for the exposed areas (2) perforated flanges in the electrical gutter where the cold-cathode lighting is mounted for the interior spaces. The furred ceiling spaces above each story act as recirculation plenums.

Because there are a number of days in Portland when it is necessary to dehumidify the air entering conditioned spaces, warm and cool plenum systems are provided. Air from them mixes in proportions determined by 11 zone thermostats for the typical floors—one for each corner where there are two exposures, one for the interior areas and two for the east side where the shading from a tall building affects heating load.

If desired, 100% outside air can be used for flushing under manual control. Normally, an outside thermostat reset by a humidity controller does the job when outside temperature ranges between 60 and 75 F dry bulb, and the dewpoint stays below 55 F. Such periods, with 100% outside air in use, reduce the average heat-pump load.

Heat-Pump Service. Just how does the heat pump serve the air-conditioning system loads? The nature of the loads falls into three types where: (1) heating demand is greater (2) cooling is greater than heating (3) cooling only is needed.

For the first case, Fig. 3 applies. Here the heating circuit is a closed one. The basic heat supply originates in the upper or condensing sections of the four turbo-vacuum compressors, two of which are 200-ton capacity, and two 70-ton. Under design conditions of outside air at 10-F dry bulb, circulating water enters the condensers at 86 F. In passing through the condenser the water cools and condenses the gaseous refrigerant, Freon, picking up heat in the process to leave at about 101 F. From here the hot water goes to the heating coils and fan units.

Water temperature in the heating system is maintained by an immersion thermostat reset by outside temperature. Should there be a need to change water temperature a step-controller and selector start up or shut down compressor and condensing units.

Meanwhile, the evaporator or cooling circuit receives the liquid refrigerant and evaporates it. Heat for the evaporation comes from two warm water wells, No. 1, and 2, about 150 ft deep, which deliver up to 600 gpm at 63.5 F. This water goes first to a settling tank, then under float-controlled pumps to join with the cold-water return. Resulting 900-gpm mixture at 58.7 F passes through cooling pumps into the evaporator where it gives up enough heat to drop to 50.4 F. From here, water flows to the cooling coils in the air-conditioning units.

Chilled water leaving the cooling coils goes through a recovery coil *A*, Fig. 3, 4, to pick up heat to around 55 F from conditioned air being exhausted. Then the water enters reconditioning coils *B* to preheat the incoming air.

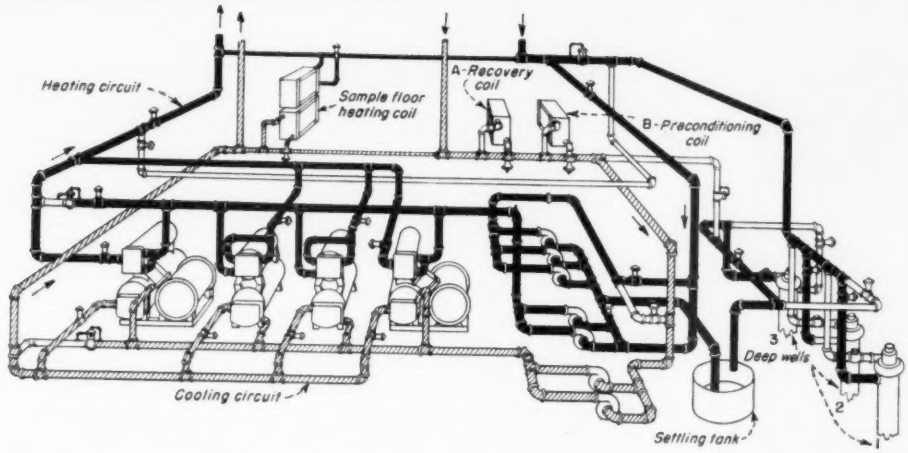
Once the chilled water passes through these coils its average temperature is about 49 F. It then splits as required. A thermostat in the chilled-water return circuit, reset by outside temperature conditions, controls the split. It prevents water in this circuit from getting too cold by operating a valve, which admits 63-F well water in the settling tank to this circuit.

As heating and cooling loads reach balance at 55 F outside temperature, the cooling-water system operates as a closed circuit without addition of well water.

More Cooling Needed. The second heat-pump system load assignment is for cases where cooling is greater than heating (from about 50-75 F outside temperature). Here, Fig. 4, the cooling circuit is a closed one. Cooling pumps push 900 gpm of water at 54 F through the chill sections (the evaporators) of the turbo-vacuum compressors, and from them at 48 F to the cooling coils on each floor. But return flow bypasses the recovery coil and continues to recirculate.

As the air passes over the cooling coils it becomes both cooled and dehumidified. So it must be preheated before transfer through the ducts. The reheating is handled in this way.

The heating circuit receives hot water at 85 F from the upper (condenser) section of the turbo-compres-



4 Where cooling load is greater cooling circuit is closed. Chilled water goes through evaporator section of compressors. After performing its reheat job this water enters the return circuit where it is split. This split is determined by the amount of reheat needed. To control the temperature of supply hot-water, well No. 3 delivers a controlled-amount of water at 57 F to mix with the returns (usually about 76-80 F). The mixture continues to the upper section of the compressor.

Amount of cold water delivered by the well replaces an equal amount of hot return water. This replaced water is wasted through the casing of No. 1 and 2 wells.

In the case where cooling only is needed (outside temperatures 75 F and above), the cooling circuit stays a closed one. At design cooling conditions of 95-F dry bulb, 70-F wet bulb, the chilled water leaves the evaporator section of the turbo-compressors at 42 F. After it is pumped through the cooling coils it bypasses the recovery coil and circulates through the preconditioning coils. This preconditioning cools off incoming fresh air before it passes over individual cooling coils.

The heating circuit is completely open. All heating coils are bypassed. Water from No. 1 well, regulated in quantity by condenser pressure, enters the settling tanks at 57 F. From there, the settling pumps at slow speed deliver the water through the compressors and by way of the heating circuit it is wasted to the casings of No. 2 and 3 wells at around 83 F. In this case the turbo-compressors do not serve as heat pumps since no advantage is taken of any heat pickup in the condenser sections.

All changeovers, that is of valves and switches to meet the changing loads, are completely automatic.

Operating Experiences. Early in the winter the following operating procedure was set up. When afternoon temperatures fell to 55 F or less some heat-pump capacity was provided through the night to reduce morning pickup load. Starting at about 10:00 pm until 6:00 am a single 70-ton machine, or two (if outside temperature was below 30 F), was run on manual control. All outside air intake and exhaust fans except in the toilet rooms were shut off. Then at 6:00 am all machines went on automatic operation and outside air was again supplied. This continued until 6:00 pm. Outside air was cut off but the machines remained on automatic until 10:00 pm.

This system gave (1) heat-pump operation under higher efficiencies during the pickup load (2) a reduced pickup period, which lowers electrical demand superimposed on normal building demand.

Water Quantities. Amount of well water used as a heat source ran much less than expected. And along with it the period during which the system was in balance—that is, an exclusive interchange between heating and cooling—was much greater than anticipated.

There were many days during which temperature averaged between 44 and 57 F. The only time the heat-pump system needed well water was during the morning pickup period.

I — Predicted and Actual Power Use, 100 Kwhr

Month	Predicted[1] 1940	Predicted[2] adjusted to 1948-49	Actual 1948-49	Building occupancy %
May	830	725	624	56
June	1033	1110	1080	62
July	1065	1060	993	74
Aug	1253	1153	1080	89
Sept	909	932	930	91
Oct	705	730	809	92
Nov	720	854	809	93
Dec	720	1112	894	94
Jan	814	1650	1640	95
Feb	689	1098	1045	95
March	627	812	705	95
Total	9365	11,218	10,609	

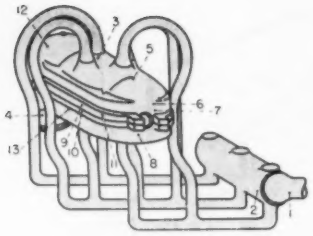
[1]Predicted use based on Portland Weather Bureau charts for 1940
[2]Predicted values corrected for degree days, operating hours 1948-49

II — Actual Heat Input, Output for Selected Days

Twenty-four hour average, 1000 Btu per hour

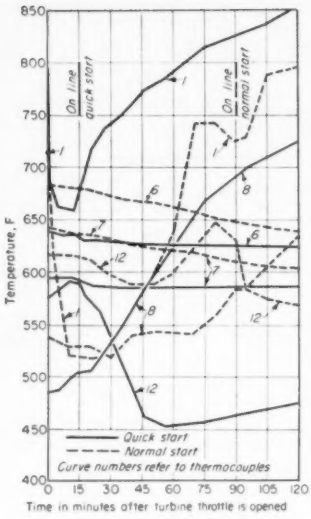
Date	Average temperature	Condenser heat output	Heat input: Compressors only	Heat input: Compressors & auxiliaries[1]
Jan 20	28	2240	566	623
Jan 25	22	2510	623	715
Jan 26	23	2500	623	702
Jan 30	36	2000	453	510
Feb 2	34	2220	510	554
Feb 8	40	2030	398	418
Feb 16	51	1570	283	306
Feb 17	44	1658	398	442
Feb 18	36	1930	453	500
Feb 21	41	2020	458	479

[1]Deepwell pumps and settling-tank pumps

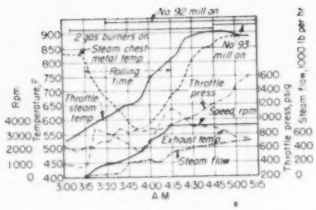


Thermocouple number and location:
1—Steam inlet, primary valve
2—Valve chest, on primary valve
3—Top casing, over 8th stage
4—On exhaust pipe
5—Top casing, head end
6—Top flange, right side
7—Bottom flange, right side
8—Bottom casing, head end
9—Top flange, left side
10—Bottom flange, left side
11—Bottom casing, under 8th stage
12—Top casing, exhaust end
13—Bottom casing, exhaust end

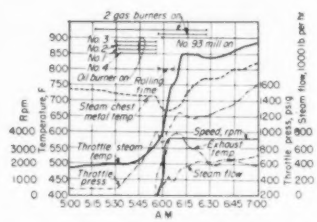
1 Thermocouples were placed on various points of No. 6 topping turbine



2 No. 6 unit temperatures vary much less during quick starts of 15 min



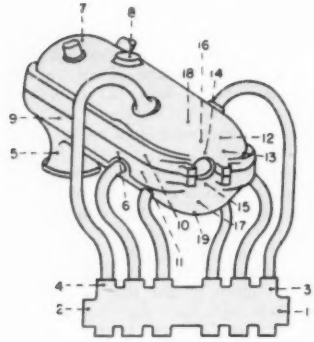
5 No. 9 steam-chest metal temperature drops 260 F during normal slow start



6 No. 9 steam-chest metal temperature drops only about 60 F on fast start

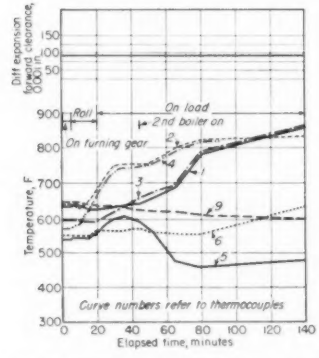
How Quickly Can Steam

Extensive trials show turbines should be put on line quickly after several hours shutdown. Five-minute starts predicted for high-pressure units will simplify operating procedure



Thermocouple number and location:
1—Steam inlet, right side
2—Steam inlet, left side
3—Valve chest, right side
4—Valve chest, left side
5—On exhaust pipe
6—Bottom casing, under 7th stage
7—Top casing, exhaust end
8—Top casing, over 7th stage
9—Bottom casing, exhaust end
10—Top flange, left side
11—Bottom flange, left side
12—Top flange, right side
13—Bottom flange, right side
14—Top casing, head end, at gland
15—Bottom casing, head end, at gland
16—Top casing, head end, above gland
17—Bottom casing, head end, above gland
18—Top casing, head end at top
19—Bottom casing, head end at bottom

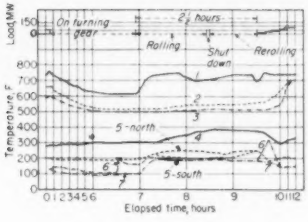
3 Thermocouples were also peened on casing of No. 5 h-p topping turbine



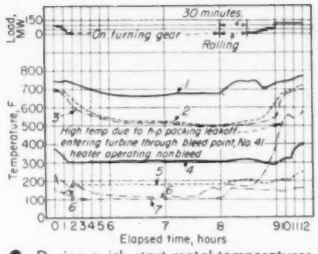
4 Differential expansion of No. 5 unit remained constant during quick start

► ADDITIONAL EXPERIENCE and experiments in the rapid starting of large turbines were discussed before the American Society of Mechanical Engineers, Metropolitan Section, on May 12, 1949 in New York, N. Y. A paper by J C Falkner, D W Napier and C W Kellstedt, all of Consolidated Edison Co of N. Y., extended the data of a previous paper presented before the ASME semiannual meeting in June 1947 (see POWER, Sept 1947, p 93). Also presented was a preview of the paper, "Operating Characteristics of the 100,000-kw Essex Turbine Generator," by S Neal, General Electric Co, and V S Renton, Public Service Electric & Gas Co, giving similar data for a new 1250-psig 1000-F unit (POWER, Oct 1948, pp 89-91). The latter paper, No. 49-SA-28, was presented at the ASME semiannual meeting in San Francisco, Calif., June 1949.

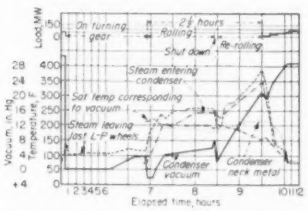
Quick Starting. During rapid starting, throttle steam temperature is held equal to or slightly higher than the metal temperature of the turbine steam chest. If a unit has been running on the turning gear at 3 rpm during a shutdown of a few hours it can be brought up to speed and synchronized in 12 to 15 minutes. Load-increase rate is then limited so steam-chest-metal-tempera-



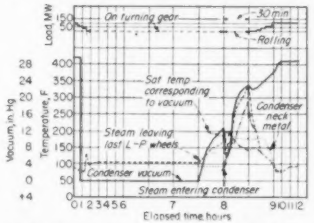
7 Metal temperatures on East River No. 4 vary gradually during long start


Load, MW
Temperature, F
30 minutes
On turning gear
Rolling
High temp due to h-p packing leakoff entering turbine through bleed point, No 4r heater operating non-bleed
Elapsed time, hours

9 During quick start metal temperatures of No. 4 vary through narrower range

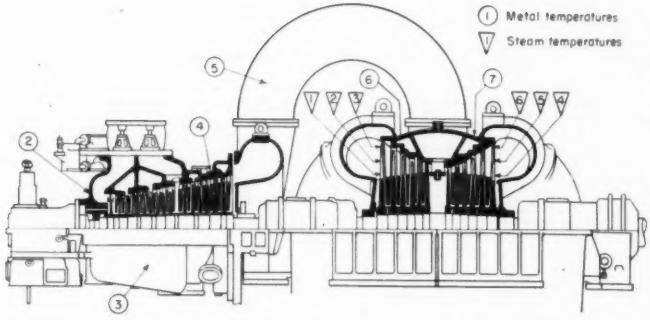


8 Temperature of steam entering condenser rises because of windage



10 Quick start limits time in which 1-p casing is subjected to high temp

Turbines Be Started?



11 Large exhaust blading of 160,000-kw Unit No. 4, East River, heats steam to condenser during starting to rather high temperature because of windage effects

ture-increase rate does not exceed 100 F per hr.

Fig. 1 shows where thermocouples were peened at various points on the turbine shell of Unit No. 6, Waterside Station, a 65,000-kw topping unit. Fig. 2 compares the temperatures measured at the various points during both normal and quick starts. Thermocouple 1 shows the steam chest, cooled through a 200-F drop on a normal start, but only cooled through 130 F during a quick start. However, the average temperature remained much higher. Up to April 19, 1949 a total of 188 quick starts had been made on four topping units at Waterside Station.

During overhaul of one of these units, it was found there had been a slight spindle shroud rub on the leading edge. Thrust-bearing clearance was normal but the bearing fit supporting the thrust-bearing housing allowed additional axial spindle movement. All nozzles, buckets, shrouding and spindle were magnetically tested, with no cracks found. This showed that quick starts did not produce adverse effects.

Fig. 3 shows the thermocouple setup on Unit No. 5, Waterside Station. Fig. 4 gives the temperature variations during a quick start and also the record of differential expansion between spindle and casing. During the entire start the differential expansion stayed absolutely constant.

Sherman Creek Trials. Up to May 12, 1949 a total of 25 quick starts had been made on Unit No. 9 at this station, a 50,000-kw 1600-psig 950-F topping turbine-generator. A single boiler feeds this turbine, raising a problem of steam-temperature control at 25% boiler load, which is the full-speed no-load turbine steam demand. (Since two boilers feed each turbine at Waterside, the minimum steam demand is a 40% load on one boiler. At this load steam temperature is within control range.)

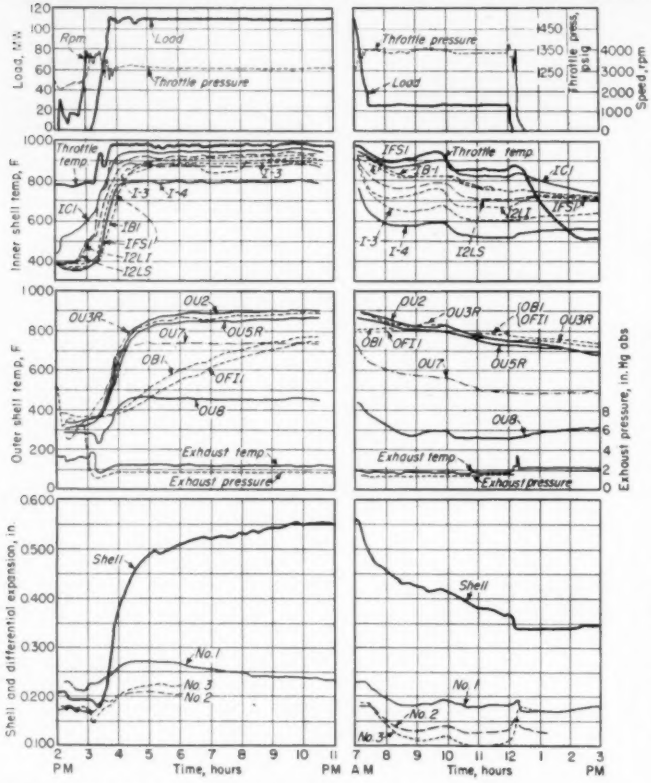
Another problem was the evaporation of accumulated condensate in the pendant-type superheater (POWER, Feb 1949, p 114). This condition and temperature control will be solved in two steps. The first step involved using four oil burners, in the upper part of the furnace and just ahead of the superheater during starting. The second step will be in provision of an additional drain bypass around the topping turbine to allow quicker clearing of low-temperature starting steam from the superheater.

Fig. 5 shows the variation in temperatures, pressure, speed and steam flow during a normal one-hour start without using the oil burners. Note the large variation in steam-chest metal temperature. In contrast, Fig. 6 gives the changes in the same factors during a quick start, using the four auxiliary oil burners. The steam-chest temperature drops only about 50 F. Until the additional bypass is installed the steam temperature will be deliberately reduced before the unit is taken off the line to minimize the variation of metal temperature during starting.

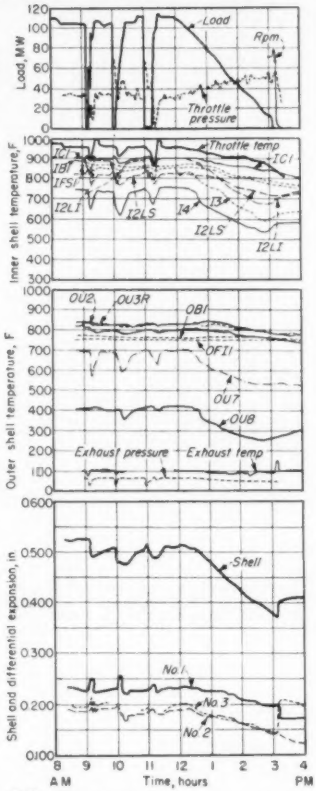
It should be emphasized that quick starts can be made only where the metal temperatures are somewhere near the steam temperatures. When starts are made after long shutdowns with turbine parts cooled to near room temperature, the preheating should be done slowly in conformance with the 100-F-per-hr rise limitation.

Condensing Turbines. The 160,000-kw Unit No. 4 (400 psig, 750 F) at East River Station was the first condensing unit on which Consolidated Edison tried quick starts. Fig. 11 shows location of

BEHAVIOR OF 1250-PSIG 1000-F ESSEX TURBINE DURING STARTING AND STOPPING



12 Starting and stopping tests of Essex No. 1 investigated temperature changes in inner and outer casings and expansions of turbine rotor and stator elements



13 Three load dump tests were made on Essex No. 1 without difficulties

thermocouples for starting-procedure investigation. Before the turning gear had been installed in 1939, the unit was rolled for 2½ hr during every start. Effect of this procedure is shown in Fig. 7 and 8. The first shows gradual temperature changes in the h-p end of the unit. The sudden change in point 6 (prior to 10 hr) is caused by the pressure rise in the h-p packing leakoff with increasing load. The leakoff discharges into the bleed line between heater and 21st bleed point. With the heater shut off, the high-temperature steam enters the stage. As soon as the heater begins operating, the temperature drops to normal.

Fig. 8 shows large temperature changes in the exhaust end of the turbine. The last-stage blades have a tip speed of 1015 ft per sec and, as shown by the curves, heat the exhaust steam to a high temperature. This heating becomes aggravated when increasing the vacuum, reaching a top of 390 F. As soon as the unit is loaded and the vacuum brought up to operating value the exhaust steam temperature drops to saturation value. Maximum temperature values of exhaust steam are followed by cooling rates on the order of 800 F per hr. It is surprising that this rapid cooling has not caused any casing cracking, especially since shells are of thin cast-iron sections, and the flanges very heavy. Perhaps modern-day limits of 100-F-per-hr temperature change, as suggested by some manufacturers, are overconservative.

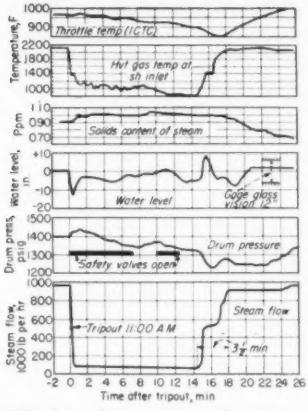
With the turning gear, starts had been made in 1½ hr as normal procedure. Fig. 9 and 10 show temperature variations for a 30-min start. Front-end-metal temperature changes are gradual, but the exhaust-steam temperatures again rise rapidly. Beneficially, though, the peak temperature is less with the fast start. Installation of supplementary piping to avoid introducing hot leakoff steam into the 21st stage is being studied.

Fast-Start Advantages. Estimates show that if starting time of all topping and condensing machines on the Consolidated Edison System could be reduced to 15 min or less, savings in auxiliary power, stack and river losses and fuel would amount to about $250,000 annually. In forced outages, quick starts help to reduce out-of-service time.

Quick starting eases the problem on the turbine floor every morning. Instead of having several machines in various stages of a slow start, it should be possible for a crew to give full attention to one machine during a quick start.

It is fully expected that starts will be reduced to 5 min or less in future. Faster rates of loading during the first few minutes of operation will help in

BOILER LOAD-DUMP TEST



14 Rate of load pickup on Essex boiler was limited by drum water level

reducing heating and cooling of exhaust ends. Consolidated Edison is now working on developing procedures for quick starting of all its various types of condensing machines.

Essex Station Trials. Forty thermocouples were placed in various locations on this unit. A series of tests were run to determine: (1) steady-state conditions (2) effect of starting-time duration (3) effect of load and throttle-steam temperature changes (4) effect of load dumping and fast load pickup (5) effect of preheating generator field before and during starting.

Tests were made at normal running clearances. At no time was there evidence of distress or unusual conditions. Neither shaft eccentricity nor bearing vibration changed appreciably from normal. After 14 months' service the low-pressure turbine and the last 3 stages of the h-p turbine showed no trouble from these tests. Time did not allow examining the front end of the h-p turbine.

Most starts were made from turning-gear speed after weekend shutdowns with initial turbine-metal temperatures of about 450 F. Starting time decreased from 98 to 22 minutes as the test progressed. Loading rates varied from ½ to 2.75 mw per min from no load to either 40- or 110-mw total load. Usually, higher loading rates were made with the shorter starts.

Fig. 12 shows the data taken from a 60-min starting and an unloading test. Throttle-steam pressure was held near 1250 psig for all starting tests. For the average start, throttle-steam temperature was about 750 F. In the figure, *IC1* is the steam-chest temperature. Thermocouple code numbers with *B* refer to a casing bolt; *F* refers to a point on the casing or shell flange. All other thermocouples were at various points on the inner and outer shells.

Expansions were obtained with standard-type instruments. One indicator at the front-bearing standard measured total shell expansion up to the exhaust hood. No. 1 differential indicator mounts on the coupling between h-p and l-p elements measuring difference of h-p turbine rotor and shell expansion from the thrust bearing. No. 2 mounts near the coupling between turbine and generator, and No. 3 on the coupling between main and house generators.

Conservative starting and loading practice depends on the rates at which temperatures throughout the machine approach their steady-state levels. Rate of throttle-steam temperature increase should be made as constant as possible to reduce the temperature stress in the shells. Recommended procedures for this particular unit as derived from the tests are:

Initial turbine temp, F	*Starting time, min*	*Loading rate, mw per min*
150	50	1
450	20	3
750	10	5

After the remaining tests have been completed and analyzed it is expected these recommendations can be altered to permit higher loading and temperature-change rates.

Unloading or lowering throttle-steam temperature causes the rotor to contract faster than the shell. As long as dry throttle steam is supplied any amount of load can be dropped at a rate of 5 mw per min. Safest unloading procedure drops all load instantly. During unloading, throttle temperature should be held as high as possible.

Load Dumping. Load was dumped by opening main and auxiliary generator circuit breakers, see Fig. 13. After a no-load period from 3 to 15 minutes, loads of over 110 mw were picked up within 13 to 19 min. For one test the auxiliary-generator circuit breaker was not opened. The three tests are shown in Fig. 13.

On load tripout the turbine reached a maximum speed of 106.1% of normal. This compares with calculated time of 0.85 sec to reach 110% speed with full-load steam flow.

Boiler Performance. In a discussion, H H Poor, Babcock & Wilcox Co, related the boiler behavior during the load dump tests on the Essex Unit No. 1. Oil was fired for greater flexibility. Boiler master controller, feedwater flow, fuel-oil rate, induced-draft and forced-draft fans were on hand control. Spray attemperators were on automatic control. Feed pumps were also on automatic, but during load pickup were adjusted manually. Operators at the burners removed the atomizers and placed them in service as needed.

Results of the last load dump and pickup test are shown in Fig. 14. At the 11:00 am tripout the boiler was delivering 970,000 lb per hr. Steam flow quickly dropped to 70,000 lb per hr. After 14.5 min, load picked up to 50,000 kw and, in 3.5 min, steam flow rose to 920,000 lb per hr.

At steam flow cut off, the superheater pressure rose, and the lowest-set safety valve popped in about one second. All three superheater safeties and some or all of those on the drum opened. The last one closed a little more than 7 min after tripout. Two oil lighters in service again opened the low-set safety 10 min after tripout and reseated 2.5 min later.

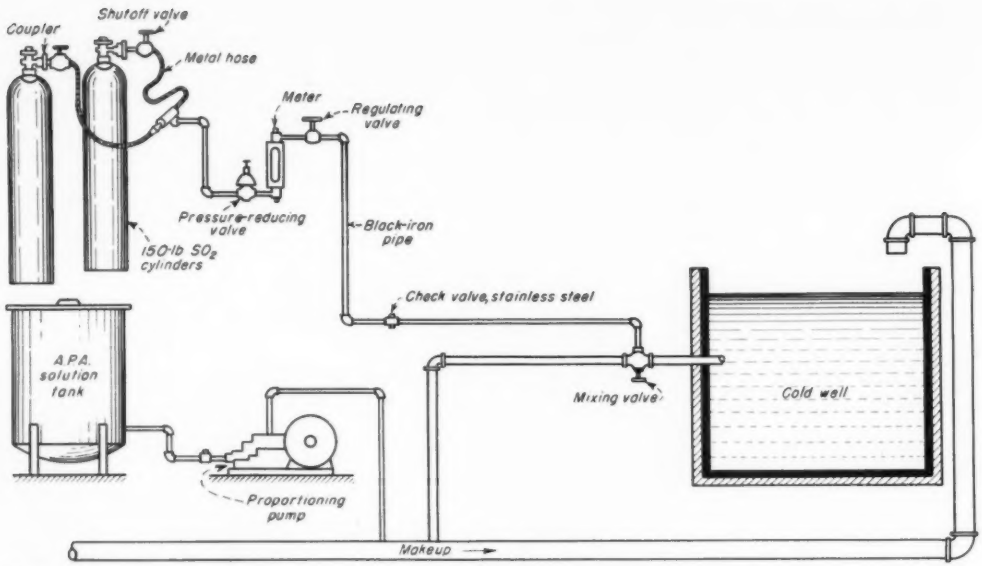
At tripout the water level dropped from +1½ in. to –13 in. but returned to –6 in. at the end of one min. Water level was held at –5 in. as load pickup was approached, and when steam flow rose to 550,000 lb per hr water level jumped to +9 in. Load was held at this value for 2 min until water level dropped to –4 in.

Water level in the drum is limiting factor on load pickup. It was concluded that with optimum regulation and coordination of feedwater and load increase, full boiler load could be picked up in less than 3 min without raising water level higher than +10 in. or increasing the steam solids content.

Test Limitations. No temperatures were measured on the nozzle partitions, diaphragms or rotor of the turbine. Bucket and partition edges will heat rapidly because of small mass and may cause permanent distortions. Temperature stresses in the shaft and wheels must be considered; it is hoped that means for measuring temperatures of rotating parts will be developed. Such data would complement the theoretical work now proceeding.

Some effects of rapid load changes or temperature variations may cause small permanent distortions, which may be cumulative and measurable only after many cycles of starts and stops.

It is intended to report the generator starting tests before the AIEE. Results showed no restrictions on starting time or loading rate of the generators. To insure longer life and lower maintenance it is recommended that the main-generator field be preheated with an 850-amp current for 20 min prior to operation at speeds above 1200 rpm during starting procedure.



1 Gas is released from the 150-lb cylinders at about 35 psi. A pressure-reducing valve then lowers the pressure to 15 psi before the gas passes through a meter on its way to the regulating valve. A mixing valve mixes the gas and water

Liquid Sulphur Dioxide Stops Scale

If you need acid to bring alkalinity and pH into line, liquid sulphur dioxide may be the logical choice when its higher cost is overbalanced by reduced hazards and ease of handling

By **M E REINER**, *Technical Division, E F Drew & Co Inc*

► SULPHURIC ACID can be used to treat industrial cooling water where the alkalinity and pH of the water must be lowered. Unfortunately, this acid requires special handling equipment and constant vigilance to avoid possible injuries. Because of the inherent hazards involved many plants refuse to employ such strong acid.

Good Substitute. Sulphur dioxide is a fairly inexpensive chemical that offers many advantages over sulphuric acid. In considering the use of either, let's examine the function of acid materials in cooling-water treatment.

Scale formation in cooling systems is caused principally by the breakdown of calcium bicarbonate, often called the "temporary hardness" in natural water. In a once-through system, water passes through the system and out to waste with no recirculation. An open circulating system employs a spray pond or cooling tower that removes the heat absorbed by the water. In the latter system, the scale-forming tendency is increased by the concentration of water impurities that takes place.

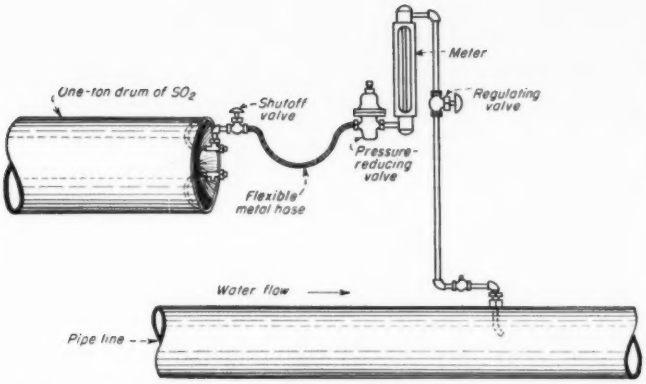
Impurities Add Up. Evaporation that occurs in the open circulating system is responsible for the concentration of impurities. In both cases, calcium bicarbonate decomposes to form calcium carbonate, the commonest form of cooling-water scale. The reaction by which this change takes place is as follows:

$$Ca(HCO_3)_2 + \text{Heat} \longrightarrow CaCO_3 + CO_2 + H_2O$$

Treatment of cooling water to prevent scale usually involves the use of small amounts of surface active materials and anti-precipitating agents. For example, poly-phosphates, tannin, lignin, alginate, starch and other materials are able to restrain this reaction from taking place. In addition, some of these materials reduce the tendency for calcium carbonate to adhere to heat-transfer surfaces.

Purpose of Acid. Although these materials prevent deposits, they are not able to prevent the decomposition of calcium bicarbonate under certain conditions, such as increased alkalinity and pH of the water involved. For, as the pH and alkalinity of the cooling water are raised, the solubility of calcium carbonate is decreased. And the tendency for calcium bicarbonate to decompose increases with increased alkalinity and pH. So acid is used to lower the pH and alkalinity. Usually, sufficient acid is used to lower the pH value and alkalinity to where the anti-precipitating agents employed can control and prevent calcium carbonate depositing.

Sulphur dioxide is also an excellent



2 For large systems a one-ton drum of sulphur dioxide can be used. Gas feeding is best as it is easier to control but substance can be fed as liquid if wanted

I — Temperature-Pressure Relation of Sulphur Dioxide

Temperature, F	Pressure, psig
20	2.48
30	7.00
40	12.40
50	18.75
60	26.23
70	34.92
80	44.98
90	56.55

II — Material Cost to Reduce 10-ppm Alkalinity per 100,000 Gallons

		Using liquid SO_2	
66-deg Baume sulphuric acid	Using sulphur burner	150-lb cylinders	One-ton drums
$0.23	$0.06	$0.54	$0.35

In Cooling-Water Systems

material for this purpose. Methods have been perfected for the treatment of cooling waters with sulphur dioxide produced in small sulphur burners. On the other hand, using liquid sulphur dioxide minimizes care and operational problems and provides excellent control of dosage and feeding.

Reaction with Hardness. Using sulphur dioxide to reduce alkalinity and pH involves the following chemical reactions:

1. $SO_2 + H_2O \longrightarrow H_2SO_3$
2. $H_2SO_3 + Ca(HCO_3)_2 \longrightarrow CaSO_3 + 2CO_2 + 2H_2O$

First reaction forms sulphurous acid by dissolving sulphur dioxide. In the second, the sulphurous acid converts the alkalinity of the water, present as calcium bicarbonate or sodium bicarbonate, to carbon dioxide and water.

Industrial-grade liquid sulphur dioxide, readily obtainable in steel cylinders or drums, is made by liquefying the gas under pressure. Pressure existing in the cylinder, therefore, depends on the temperature of the liquid in the drum. Relationship between the vapor pressure and temperature of sulphur dioxide is presented in Table I above.

Characteristics. Sulphur dioxide is a stable material that will not burn. Cylinders are equipped with fusible plugs to discharge the contents if the temperature gets above 165 F. Best procedure calls for operation under 120 F. For treating cooling water, cylinders containing 150 lb of sulphur dioxide or drums containing 2000 lb are recommended.

In practice, it requires 0.64 ppm of sulphur dioxide to reduce the alkalinity, expressed as $CaCO_3$, 1 ppm. Or, since it is more convenient to think in terms of gallons, 0.0054 lb of sulphur dioxide will reduce the alkalinity of 1000 gal of water 1 ppm.

Plant Hookup. Fig. 1 shows a typical installation feeding 1½ lb of sulphur dioxide per hour to a cooling-water system. The 150-lb cylinders release sulphur dioxide as a gas at approximately 35 psi. A pressure-reducing valve reduces the pressure to 15 psi and a rotameter measures the flow. The sulphur-dioxide gas is dissolved and mixed with makeup water flowing to the cooling tower by passing it through a mixing valve.

Since sulphur-dioxide gas is extremely soluble, a dilute solution of sulphurous acid is formed immediately. Solution strength is controlled by a regulating valve in the sulphur-dioxide gas line. A rotameter measures the flow of gas to the system in pounds of SO_2 per hour.

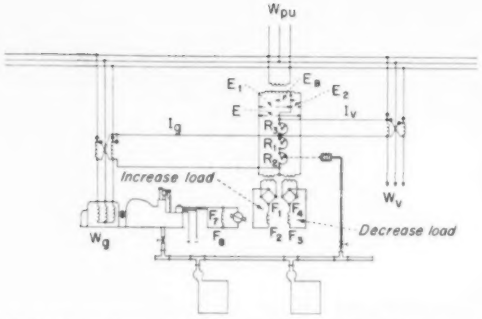
Feeding Methods. When up to ten pounds per hour are required, a system like that in Fig. 1 may be conveniently used. For larger amounts, a one-ton drum of sulphur dioxide is used, Fig. 2. In both cases, sulphur dioxide is fed to the system as a gas. It is possible by inverting the 150-lb cylinders or using the lower valve on a one-ton drum to feed the substance as a liquid. Gas-feeding method is best because it is much simpler and easier to control.

Table I shows that at low temperature insufficient pressure will be present in the drum to cause the gas to flow. If installed outdoors, it will be necessary to heat the drums during cold weather. Small cylinders may be heated with strip heaters; ton drums in a small, insulated and heated "doghouse."

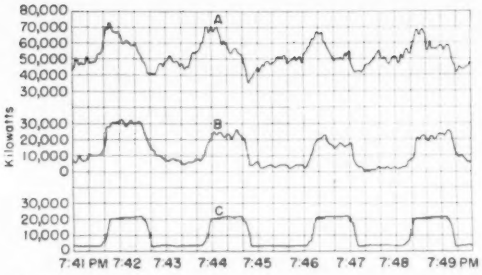
Comparing Costs. Using liquid sulphur dioxide to reduce alkalinity is more expensive than either sulphur burner gas or sulphuric acid. For this reason its application is probably limited to installations where makeup and alkalinity reduction required are moderate.

Table II compares costs for the reduction of 10 ppm of total alkalinity per 100,000 gal of water treated by sulphuric acid, sulphur dioxide from a sulphur burner and liquid sulphur dioxide.

Where poor results are being obtained in treating cooling water, and scale forms, alkalinity and pH adjustment should be thoroughly investigated. When acid is needed, liquid sulphur dioxide is the logical choice for many operations where its higher cost is more than balanced by reduced hazards and ease of handling.



1 Load regulator varies the amplidyne fields to increase or decrease generator load, keeping utility load W_{pu} constant



2 Unregulated loading where *A* is kw load on tieline, *B* is power taken from utility by consumer, and *C* variable load

High-Speed Regulator Confines Variable Load To Local Generators

Where an industrial plant ties in with a public utility, load regulator will confine all rapid electrical load changes to generators within plant. This means power can be purchased at near-constant demand rate. Further, it is possible to set regulator so turbine takes load according to available energy

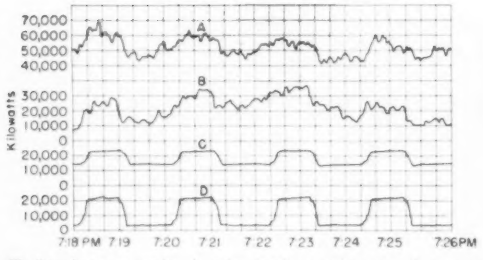
By A G DARLING, *Industrial Engineering Division, General Electric Co*

► LOAD REGULATORS come into the picture where electrical load changers are rapid, as in steel mills, and where local process steam demands through non-condensing or extraction turbines affect electrical demands on tie-line with the public utility. Regulators used in the past had response rates far below that required to offset maximum changes in load.

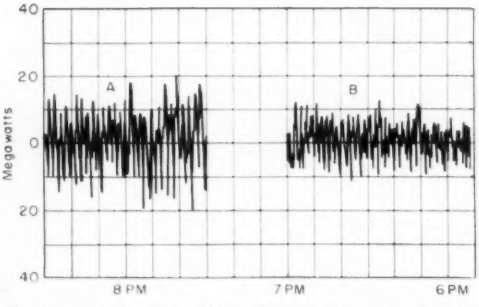
Regulators are now available with a response faster than that allowed by temperature changes, by hand operation of steam turbines, and by the rate at which energy may be drawn from steam boilers. New-type regulators respond proportionally to the amount and rate at which the primary signal varies.

How Regulator Works. The new regulator controls input energy to a prime mover, such as a steam turbine or waterwheel generator. Input energy is made to increase or decrease according to the requirements of the case, just as an operator would do if he had all information needed and could act mentally and physically as fast as conditions changed.

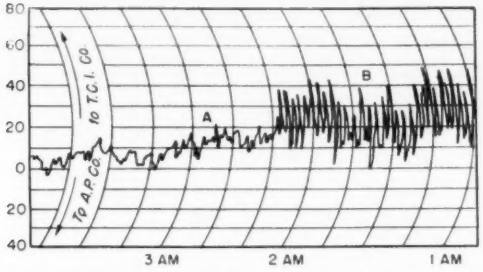
Suppose, for example, the operator



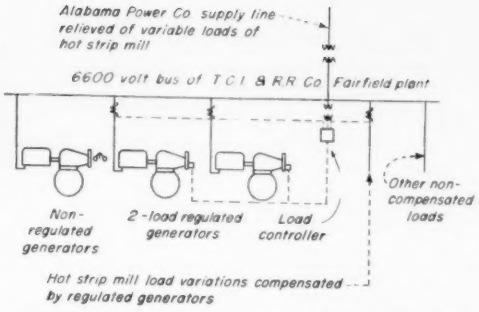
5 Regulator at work: *A* is kw load on utility line; *B*, power from utility tie; *C*, generators taking variable load in *D*



6 Load through Gorgas-Wilson Dam 154-kv tieline. *A*, without control and *B* with generators taking 50% variable load



3 Effect of Tennessee Coal, Iron and Railroad Co's hot-strip mill load on unregulated power taken from Alabama Pwr Co


Alabama Power Co. supply line relieved of variable loads of hot strip mill
6600 volt bus of T.C.I. & R.R. Co. Fairfield plant
Other non-compensated loads
Non-regulated generators
2-load regulated generators
Load controller
Hot strip mill load variations compensated by regulated generators

4 Here's simplified arrangement of regulated and unregulated generators to relieve utility tie of variable plant load

wished to have his steam turbine-generator take all the variations of load in his plant so he would purchase only a constant amount of power from a public utility. To do this himself, he would observe the wattmeter measuring the variable load and the wattmeter showing the generator output. He would increase or decrease the generator load at the same instant that the plant load changed to prevent any change in power taken from the public utility. He would do this by adjusting the turbine governor motor.

If load changes were gradual he could hold the public-utility load at a fairly constant level. He would do better if he had a variable-speed governor motor and could change amount of energy to the turbine at the same rate at which load increased or decreased. The operator would further improve the results if he could sense that a load change was ending and prevent an overcorrection of any appreciable magnitude.

In a nutshell, the new regulator does these things and more, and at the speed that the load varies. More detailed explanations follow but a glance at Fig. 1 serves to illustrate the several components that make up the general case; steam boilers, turbine-generator W_g, circuits to the variable plant load W_v, and connection to the public utility W_{pu}. Power, taken by the load W_v, and power output of generator W_g are compared in the regulator circuit. This is done by creating voltages in the regulator's center circuit. These voltages result from sending the secondary current of current transformers in the load and generator circuits through resistances.

When the voltage I_1R_3 of the load is equal to the voltage I_g $(R_1 + R_2)$ of the generator, the generator load is equal to the plant load. If one voltage exceeds the other, the difference passes through the potential transformers to the rectifiers. They, in turn, impress that voltage on the proper field of the amplidyne generator. The amplidyne then produces a voltage in the right direction to move the governor motor compensating for load inequalities. A stabilizing field, not shown in the diagram, assists in preventing over-compensation and hunting.

By increasing voltage E_B, the generator can be made to carry a base load. By increasing the resistance R_3, more of the variable plant load will be taken by the generator. The resistance R_2 may be varied to follow the available steam pressure which, in turn, is a measure of the available fuel. Thus the total generator loading is modified to suit the fuel conditions.

In simple terms, the amplidyne generator is a rotating dc machine driven by a motor or other means in which armature output is a large multiple of the field strength. Its time constant is very short, making it both sensitive and prompt.

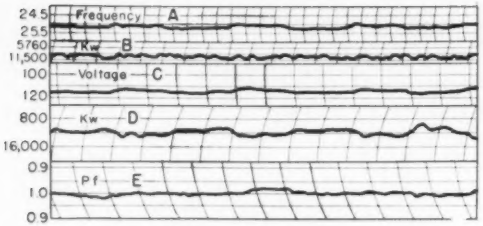
Typical Installations. Regulator has been installed in the Tennessee Coal, Iron & Railroad Co plan at Fairfield, Ala., and at the 3rd Avenue Pittsburgh plant of the Jones and Laughlin Steel Corp. One additional regulator will shortly be installed in a steel company, and two more in a Midwest public utility system. The latter two regulators are similar in principle to the others but differ in some details, as explained later.

The plants mentioned have their own steam turbine-generators and each has rapidly changing loads varying at rates up to 7000 kw per sec, or possibly higher. The TCI & R plant's hot-strip mill loads were identified, Fig. 2 and 3, among the various other loads of the mill, as those that passed through the Alabama Power Co system, the Tennessee Valley Authority system, etc, until absorbed by the generators at Philo, Ohio. Fig. 2 shows the unregulated loads where: *A* is the kilowatt loading on Gorgas-Wilson Dam 154-kv tieline between Alabama Power Co and TVA; *B*, total power taken by TCI & R Co from Alabama Power Co; *C*, the hot-strip mill load of TCI & R Co. When loading of the tielines between the Alabama and the Tennessee systems was sufficiently high, the strip-mill peaks caused excessive loadings and occasional trip-outs of the tielines.

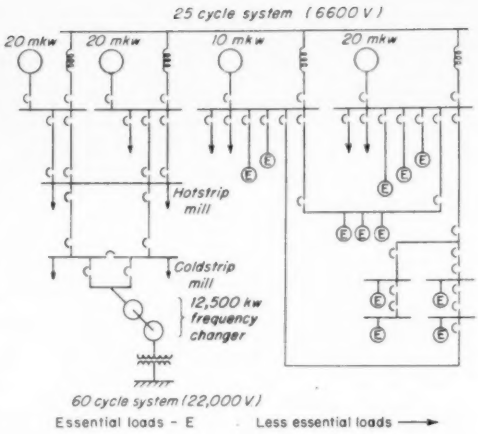
To relieve this situation, two 20,000-kw condensing turbine-generators at the TCI & R plant, Fig. 4, were assigned to carry any desired portion of the strip-mill peak—some 20,000 kw in magnitude. Tests showed these peaks, occurring in cycles of 140 to 175 seconds' duration, could be completely absorbed by the local turbine-generators, Fig. 5, 6 and 9. Looking at Fig. 5 for the moment, *A* is kw load on Gorgas-Wilson Dam's 154-kv tieline between Alabama Power Co and TVA; *B* is total power taken by TCI & R Co from Alabama Power Co; *C* is the portion of TCI & R Co hot-strip mill load imposed on its generator by load regulator; *D* is the hot-strip mill load of TCI & R Co.

To prevent the rate at which steam is used from exceeding variable supply rate of blast-furnace gas fuel, a steam-boiler pressure regulator allows the load regulator to assign a predetermined base load and percentage of strip-mill peak load to the turbines. If pressure falls below a set limit the steam pressure regulator reduces the assigned turbine loading in proportion to pressure drop. Means are also incorporated to permit any desired ratio of loading between the two 20,000-kw turbines. The TCI regulator has been in constant service since Dec 1944.

Jones & Laughlin's 25-cycle steel plant, Fig. 8, required an independent power source to assure continuous service for essential auxiliaries as well as some additional power. A demand con-



7 Effect of load-controlling frequency changer, Fig. 8. The time elapsed between beginning and end of all recordings is about 2 minutes. Each curve explained in the text below



8 Power system of Jones and Laughlin Steel Corp, Pittsburgh Works. This 70,000-kw generating capacity system connects through a 12,500-kw frequency changer to utility system

tract with the local utility to furnish 60-cycle power appeared good provided demand could be held at a desirable limit. Variable ratio 12,500-kw frequency converter controlled by the new regulator was installed to vary the frequency ratio holding a predetermined demand through Scherbius type frequency changer. Strip-mill loads cause peaks of 25,000 kw in 5 to 7 seconds, holding for 3 to 5 seconds, and falling again in 5 to 7 seconds.

If the frequency ratio of the frequency changer were held fixed, practically all mill peaks would flow through changer to the fixed-frequency 60-cycle system. By regulating ratio of the frequency changer, a minor portion of the load changes flow through the set. The regulator throws them back on the speed-governed 25-cycle turbine-generators that have ample capacity and are supplied with ample steam and fuel. Fig. 8. Effect of load controlling the frequency changer is shown in Fig. 7; *A* is the 25-cycle frequency; *B*, the load through frequency changer at 60 cycle; *C*, the 25-cycle voltage; *D*, the 25-cycle turbine-generator load; *E*, the 25-cycle frequency-changer power factor. Frequency changer and its control have been in operation since Nov 1946, and have held the demand to its present value.

The steel company's new installation will perform the same functions as that at Jones & Laughlin; namely, holding constant tieline load by forcing the peaks from their structural, slabbing and strip mills on their 50,000-kw turbine. It is expected that the tielines, which extend through five states, will obtain relief from the mill's cyclic peaks, which are somewhat similar to those at the Jones & Laughlin plant.

The public utility's new installation will control one or both of two turbine-generators. In this instance, the purpose of the control is to force variable loads of a nearby rolling mill on the local turbines rather than allow them to be partly taken by a high-voltage tieline interconnecting remote communities. The variable loads may be shared by the two turbines in any desired proportion. Load changes of 16,000 kw are expected.

Load-Regulator Design. Basically, the circuit of the regulator is such that any deviation from preset balanced condition initiates a restoring action in proportion to the rate at which the deviation takes place, without introducing time delays intentionally.

Fig. 1 shows a simplified electrical power system consisting of a variable load W_v, a connection to a secondary power source such as a public utility W_{pu}, and local primary power source W_g, such as a steam turbine-generator.

In this arrangement the measured current is that in phase with voltage. The phase voltages are generally balanced.

Regulator positions the turbine valves establishing a balance between voltages to the two opposing amplidyne fields F_1-F_2 and F_3-F_4. This balanced condition exists when

$$E_B - I_g (R_1 + R_2) + I_v R_3 = O$$

With phases balanced,

$$I_g = W_g \div E\sqrt{3} \quad \text{and} \quad I_v = W_v \div E\sqrt{3}$$

Letting $K_g = (R_1 + R_2) \div E\sqrt{3}$ and

$$K_v = R_3 \div E\sqrt{3}$$

$$E_B - W_g K_g + W_v K_v \text{ or}$$

$$W_g = E_B + W_v K_v \div K_g$$

Main power connections are such that

$$W_{pu} + W_g = W_v$$

Substituting

$$W_{pu} + (E_B + W_v K_v) \div K_g = W_v$$

When $K_g = K_v$,

$$W_{pu} = -E_B \div K_g$$

which means that the generator W_g is carrying the variable load W_v, and the tieline load is constant.

E_B can then be set to assign any base load to the generator regardless of variations of W_v.

The relation of $K_g \div K_v$ may be modified by reducing the value of R_3, thereby assigning less than 100% of the variable load W_v to the generator.

The Variables. Resistances R_1, R_2 and R_3 are introduced for specific purposes. Consider a circuit involving only voltages E, E_2 and $I_g R_1$. With E_1 greater than E_2, the generator will increase its output until the voltage $I_g R_1$ balances the circuit. The generator will then carry a base load regardless of load value W_v.

Introduction of the resistance R_2 will then tend to modify generator loading. At some point of resistance R_2, maximum generator output can be obtained for selected values of E_1, E_2 and $I_g R_1$. With increasing values of R_2, less generator output will be obtained, thereby giving a method of proportioning generator output to steam pressure.

R_1 can be adjusted to obtain any constant base load on the generator.

Voltage $I_v R_3$ may be introduced to add a variable load to generator base load. When R_3 is a minimum, no variable load will be added to generator. But as R_3 is increased, the generator will carry a larger proportion of variable load until it is all absorbed by generator.

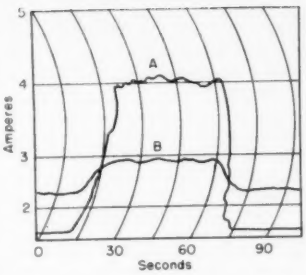
If generator is capable of carrying more load than $I_v R_3$ represents, power may be furnished to the tieline in constant amounts by making E_1 greater than E_2.

Field F_3-F_4 gives a more linear relation between amplidyne input and output, and provides a means of adjusting rate of turbine loading.

When the synchronizing motor mechanism of a steam turbine cannot conveniently be made fast enough and rugged enough to stand the service, an oil relay to the steam-inlet valve, positioned by a pilot motor and oil valve, can generally be used to transmit signals from amplidyne to move the steam-inlet valves. Using the latter method, the speed governor is placed in a *pre-emergency* position in which the speed governor can control speed if it rises slightly above normal. A simple positioning of the operating mechanism changes the turbine control from governor to regulator and return.

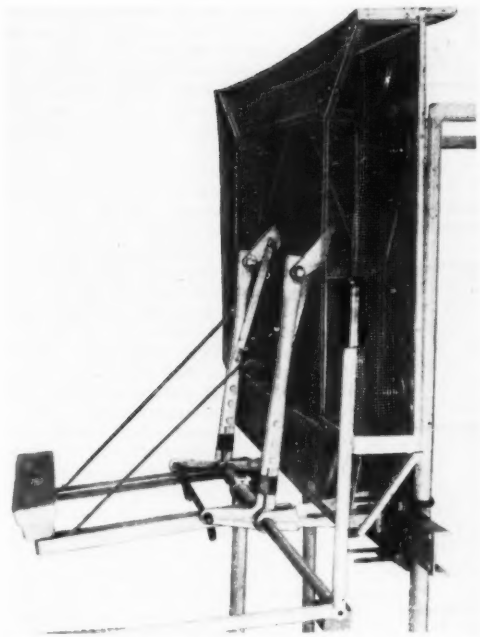
Economics of load regulation are readily determinable. Constant amounts of electric power can be purchased or generated less expensively than variable amounts of power. Therefore, to justify load regulation from the standpoint of lowest over-all power cost, the cost of purchasing power at a constant rate must decrease faster than the cost of generating power at a variable-rate increase. Costs of generating power must include the fixed charges for the regulator and its accessories and some possible increased maintenance costs of turbine and boiler operation under variable-load conditions.

If tieline transmitting capacity is insufficient to transmit unregulated loads, the fixed-charge cost of increasing tieline capacity, by enlarging line conductors, raising circuit voltage or building extra lines, may be compared with the fixed charges for adding the regulators and the incremental cost of variable-load over constant-load power generation.



9 Response of load-regulated generator with meters connected in the secondary circuit of ct's. Variable load from hot-strip mill is shown in *A*. Curve *B* shows one generator taking this load although it may be split between units

How to Test and Store Rubber Mats



LEAD COUNTERWEIGHT keeps electrodes in close contact with rubber mat. Hi-pot secondary connects across two electrodes

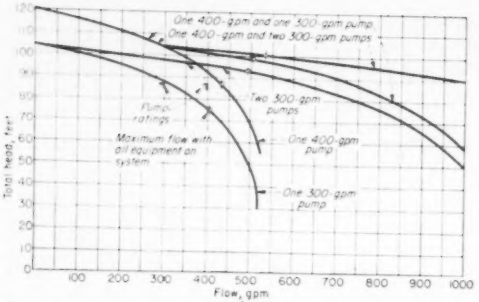
► FOR SOME TIME we toyed with the idea of making up a homemade rig to test rubber mats kept in front of our switchboards. A local craftsman beat us to it when he put together the mat tester in the photo. Rig itself is made from "odds and ends" that can be picked up around the average shop.

Welding was used throughout with the exception of the high-voltage insulators and inverted channel iron supporting linkage and screen. Note that a pig of lead serves as counterbalance.

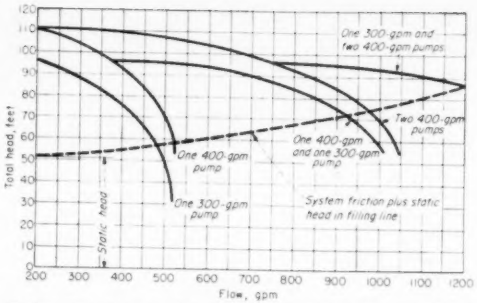
We won't go into all details of testing rubber mats since that information is found in ASTM *Specification D-178*. Nevertheless, it is worth mentioning that the mats we are concerned with are not to be used where voltage to ground exceeds 3 kv. In running the test, any portion of the matting must be able to withstand 15 kv for 1 min without failure or signs of appreciable warmth. Our test rig is really nothing more than two large flat electrodes, each covering one side of the rubber mat. The test voltage is then applied between the two electrodes. A portable hi-pot test set supplies the necessary test voltage that can be measured by connecting an ac voltmeter across low side of step-down transformer (primary connected to high side of hi-pot tester). Ground frame of hi-pot tester when in use.

Now a word of caution. Never fold rubber mats for storage or transporting since creasing will probably start an opening that will become progressively worse with time. Best bet is to roll them with heavy paper, wrapping to keep out air and sunlight. Never store rubber mats where oil vapors are present. Keep storage space dry and out of direct sunlight. Storage area should be considered a hazardous location since a small blaze can develop into a raging inferno in jig time.

P C ZIEMKE — *Oak Ridge, Tenn.*



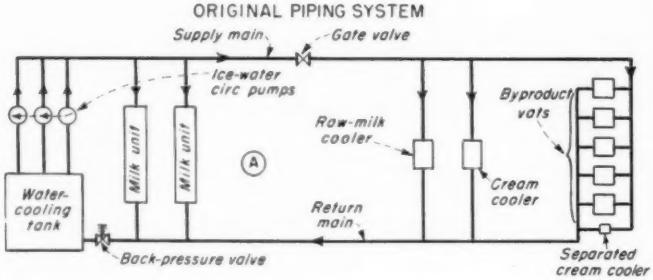
1 Tests were run by adding every piece of cooling equipment, one item at a time, for every possible pump combination

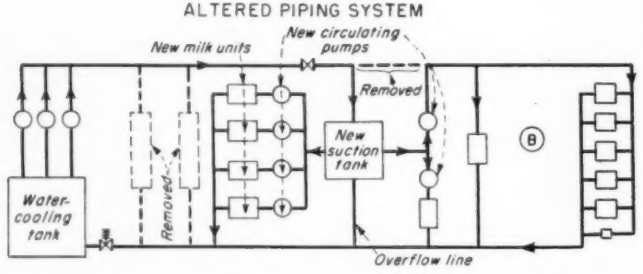

One 300-gpm and two 400-gpm pumps
Two 400-gpm pumps
One 400-gpm pump
One 400-gpm and one 300-gpm pump
One 300-gpm pump
System friction plus static head in filling line
Static head
Total head, feet
Flow, gpm

2 Impeller of one small pump had to be changed to match that of the largest unit so 1200 gpm could be delivered to tank

Balances Milk-Chilling Water Flow

When uneven pressure drop through milk processors interfered with water circulation, Milton N Krause revamped the system to give each unit the amount of water it needed. At the same time, he got enough capacity for several new milk coolers





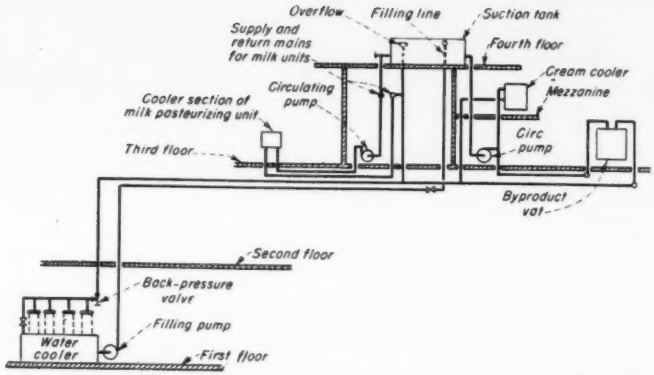
3 Each new circulating pump was selected for a flow rate required for the equipment it served at a head sufficient to overcome the pressure drop at rated flow

► ONE OF THE MOST IMPORTANT power services in a modern dairy is the ice-water cooling and circulating system. It usually comprises a water cooler, circulating pump, a supply main to the processing equipment and return main.

Poor Cooling Results. New processing equipment is usually connected between the supply and return mains, and additional water coolers and circulating pumps are installed as needed. This method worked well in one of our plants until we found that some of the cooling operations could not be done simultaneously or at the proper rate. Since this plant was to be completely modernized, the questions arose as to whether to install a new system or use the existing one in whole or part. Soaring costs dictated that we salvage as much of it as possible.

With the existing system, Fig. 3A, all processing equipment could operate at the same time except that only two byproduct vats were used simultaneously because of the nature of the process. This setup required 988 gpm of water. Trouble was that different pressure drops, through individual cooling sections of the processors, made it impossible to maintain inlet pressures required to secure rated flow.

Flow Varied. For instance, pressure drop through the byproduct vats to secure rated flow was far greater than for any other piece of equipment so they, consequently, were deprived of water. It followed the path of least resistance through the milk units. Furthermore, the inlet pressure at each processor varied, depending on the number of circulating pumps and processors in operation at a particular time. This fact



4 Insulated suction tank was installed on the fourth floor almost directly above the new booster circulating pumps with both inlet and outlet lines through floor

By Raising Suction Tank

was borne out by a study of pump characteristic curves for single and parallel operation, Fig. 1.

No-Flow Indication. Ice-water circulating pumps were manually controlled and were not provided with meters or other devices to inform the operators as to which or how many pumps were required to meet the demand. As a matter of fact, it was not unusual to find two pumps operating in parallel at shut-off pressure! A rough check of the pump curves seemed in order so a test was run as follows: A water meter was installed in the ice-water return line on the discharge side of the backpressure valve, pressure gages were installed on each circulating pump suction and discharge. Meter and pressure gages were read as each piece of equipment was placed in operation, one by one, until all processors had water circulating through them. This was done for each possible pump combination.

Results of this test fitted the pump curves closely, but the maximum flow possible, with all processors on, varied from 405 to 535 gpm for the various pump combinations, Fig. 1. A value much lower than the required 988 gpm indicated that the high system friction head was probably caused by high-pressure drop through each byproduct vat.

By changing pipe sizes and equalizing the resistance of each of the parallel cooling-water circuits we could obtain proper flows. But four modern milk units were to be installed in place of the two existing units and the multiplicity of parallel circuits complicated the problem.

We decided to install a booster pump for each of the more important processors and one booster pump for the remainder of the equipment in which cooling rate was not too critical. Each booster pump would be selected for the flow rate required for the equipment it served at a head sufficient to overcome the pressure drop at rated flow plus a piping allowance. Fig. 3*B*.

Revamped System. We used the existing ice-water circulating pumps and existing mains and branches wherever possible. An insulated suction tank was installed on the fourth floor almost directly over the new booster or circulating pumps, Fig. 4. Two suction lines were dropped to the floor below. One supplied water to a header connected to the circulating pumps for the new milk processors, while the other one supplied water to a raw-milk cooler circulating pump and a byproduct circulating pump. Ice water was supplied to the tank by extending the existing supply main upward. Tank overflow line dropped downward and connected to the existing return main. Return water from the milk units entered a return header, which discharged into the return main through the suction-tank overflow connection.

Discharge from the byproduct circulating pump was split, one branch delivering water to the cream cooler, whose return branch was already connected to the return main. The other branch, dropping to the floor below, discharged into the existing supply main to the byproduct vat header. The return main was left intact, except a small section which had to be made larger to carry the flow from the remodeled raw-milk cooler.

Because the supply main had now become a filling line for the suction tank and the circulating pumps were now filling pumps, the impeller of one of the smaller pumps had to be changed to match that of the largest pump so an estimated 1200 gpm could be supplied to the tank, Fig. 2. With the proposed arrangement most of the new installation work could be done while the existing system operated.

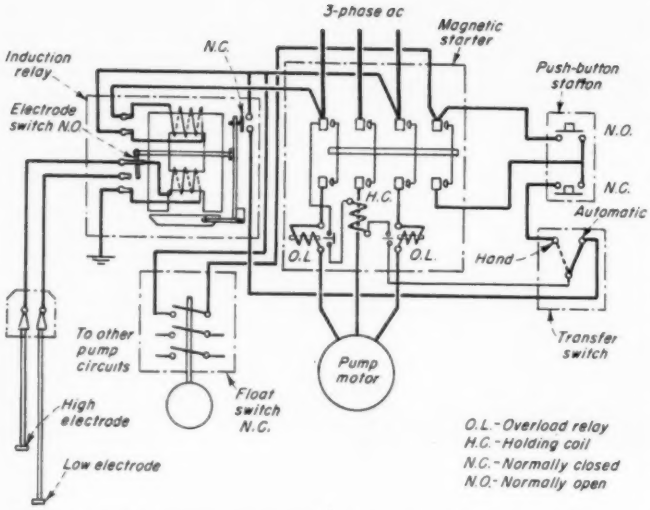
After one week's operation with the new equipment on full production and existing milk units standing by in case of trouble, it was decided that the old milk units could be removed. Thus the new system went into service without a "hitch" or much overtime work.

Pump Control. An interesting feature of the new installation is the means of controlling the operation of the filling pumps to meet the demand for ice water. This is effected by a series of control electrodes arranged at different levels. The electrodes are wired to Type DH Induction Relays, manufactured by the B/W Controller Corp, and connected into the magnetic starter of each pump, Fig. 5.

As the water level in the suction tank drops below the longer electrode for Pump No. 1 the secondary circuit of its relay opens, dropping the armature and starting the pump. If the draw is less than the amount of water supplied by the pump, excess flow into the tank causes the water level to rise until it reaches the shorter electrode, closing the secondary circuit, and stopping the pump. In this way it operates intermittently. If the drawdown is greater than can be supplied by one pump the water level drops until it falls below the longer electrode for pump No. 2, thus starting it. Pumps No. 1 and 2 will now operate in parallel and, if needed, pump No. 3 will start in like manner.

Manual Control. A transfer switch, Fig. 5, is provided for manual or automatic operation of each magnetic starter. Manual operation is used when starting up the cooling system before a day's run. This permits pumping ice water into the suction tank even though this tank is full, and displacing the relatively warm water from the previous day's run so it flows into the overflow and returns to the cooling coils.

Another interesting feature is that the suction-tank overflow is connected to the return main instead of running a separate overflow line back to the cooling tank. The overflow line and return main were calculated to remove the combined discharge from the filling pumps under the gravity head available. Because the valves at the end of the return line controlling the distribution of the water over the coolers might possibly be closed, a float switch



5 Operation of the pumps was controlled by a series of electrodes placed in the tank at different elevations so they would go on and off according to system load

was installed on the suction tank as an emergency shutoff for the filling pumps. Fig. 5.

Overflow Tests. Upper end of overflow pipe was belled out to take full advantage of the gravity head. To test the capacity of the overflow line, one pump was started manually. Water level in the suction tank rose above the overflow level, but immediately dropped as the overflow pipe filled with water. Pump No. 2 was then started manually, but the overflow pipe could not remove the combined discharge of both pumps. Evidently there was a restriction in the line. A quick check located it at the backpressure valve. The "guts" of the valve were removed and the test repeated. This time the overflow line easily took away the combined discharge of all three filling pumps.

An additional feature, installed later, is a single-pole rotary switch linked to the emergency-stop float switch. This scheme closes a circuit to an alarm and light in the engine room when the filling pumps stop because of a restriction in the overflow line.

The allowable floor load determined tank height. Its size was fixed by the relationship of filling pump capacities and the probable draw at given operating conditions. Capacities of the filling pumps in Fig. 2 show the possible combinations and are the intersections of the characteristic curves with the filling-line system head. The electrodes were set to give the pumps plenty of time to accelerate and decelerate when running intermittently for any operating condition, and also to permit them to run frequently enough so there would be no temperature rise in the suction tank when no water was flowing into it except, of course, when shut down for the day.

Return Pressure. Removal of the spring and disk from the backpressure valve caused some concern as it had been depended on to give zero pressure at a point in the return main where the branches and overflow line came together. A test was run with water flowing through each piece of equipment while observing the pressure gage that had been installed at that point. The various pieces of equipment were cut out of service one by one. At maximum flow in the return line the pressure at the test point was 3 psi, whereas at the smallest flow possible the pressure was minus one inch of mercury. For all practical purposes, these pressures are satisfactory so no attempt was made to install a lighter spring or disk in the backpressure valve. A test of filling-line flows with the various pump combinations agreed with Fig. 2 by +5%. Moreover, tests of other equipment showed that the measured flows were more than sufficient for a satisfactory cooling condition.

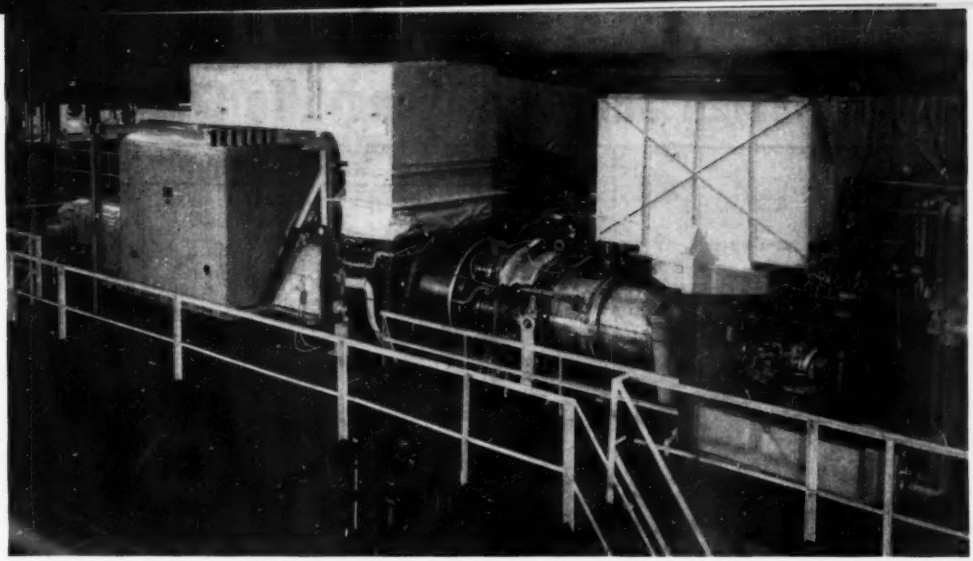
Solvent Fumes Can Be Dangerous

► PEOPLE HANDLING volatile solvents should be instructed to report promptly any feeling of discomfort. Dizziness, headache, eye difficulties, weakness, nausea, and other stomach upsets may be due to other causes. But they can also result from inhaling solvent vapors and may serve as an early warning that medical attention is required. Neglect of such warnings may lead to serious illness.

In one instance, a man spent several hours cleaning some equipment with a substantial quantity of solvent in a basement room where there was little ventilation. Several times he felt a bit dizzy and went outdoors for a few breaths of fresh air and to get away from the odor. Since this made him feel better he said nothing about his discomfort but kept at the job until it was finished. Next day he felt much worse and by the time he consulted a doctor he was seriously ill. He had to be sent to the hospital.

In another case, a man entered a solvent tank to clean it, and made the serious error of entering without a respirator. He became ill from the heavy solvent fumes and, instead of reporting to a physician, tried to treat himself by taking a few nips of hard liquor. A doctor would have told him that alcohol intensifies the effects of solvents on the body. His self-treatment led to serious illness.

While inhalation of solvent vapors is the most frequent source of solvent illness, it sometimes happens that the liquid is swallowed by mistake. The person should be made to vomit and a physician should be called at once. Also, since skin contact with solvents sometimes leads to dermatitis, persons who develop skin difficulties after working with these liquids should report to a physician to prevent aggravation of their condition. *Safety Research Institute, Inc.*



FIRST U. S. COMMERCIAL UNIT, rated 3500 kw, shown on factory test bed before shipment to Huey Station, Oklahoma City, Okla.

First Worldwide Gas-Turbine Survey

► MORE THAN 60 gas-turbine units, ranging in size from 150 hp to 27,000 kw, and aggregating more than 410,000 hp, are now operating, under construction, or on order. That's what POWER's first worldwide gas-turbine survey, just completed, reveals. The following pages list engineering data.

To secure this information, we sent questionnaires to all firms known to be active in the gas-turbine field. McGraw-Hill World News representatives in London and Paris followed through with British and Continental builders. From the data thus obtained, supplemented sometimes by information published in technical journals, we assembled the detailed tabulation.

This is our first attempt toward what we hope will be a regular feature. Like all first efforts, this one falls short in some respects. We know that we would like to have more complete data on some of the units. We suspect that we may have completely missed some others, either because they were unknown to us, or because they are still restricted.

We will welcome either additional data on units listed or facts concerning gas-turbine plants now unknown to us. We have attempted to list all pertinent details suitable for tabular presentation within available space. Your comments regarding the setup of the table will be most helpful.

The tabulation is divided into four groupings: experimental and shop units, stationary, locomotive, and marine plants. This represents our own best judgment as to the nature and purpose of the plants. We would be the last to say the classification is a strict one. Certainly, some of the stationary, locomotive and marine plants are experimental, but their application is quite definitely established.

In addition to the units tabulated, Rolls-Royce is building a plant of undisclosed size for the British Admiralty (for the gunboat "Grey Goose") and Pametrada has under design a 2000-hp gas-turbine for compressor drive in a research establishment. In France, Société Rateau is reported to be building a 4660-hp plant for the Ministry of Marine, and Schneider, at Creusot, is stated to be constructing a 5000-kw shop plant. In U.S., Lima-Hamilton Corp is developing free-piston units for naval and locomotive applications.

POWER is indebted to the following manufacturers of gas turbines for their cooperation, which made this survey possible. Letter symbols are those used to designate firms in the table.

BUILDERS OF GAS TURBINES

AC—Allis-Chalmers Mfg Co, Milwaukee, Wisconsin, U.S.A.
B—Boeing Airplane Co, Seattle, Washington, U.S.A.
BB—Brown, Boveri & Co, Ltd, Baden, Switzerland
BE—Brush Electrical Engineering Co, Loughborough, England
BT—British Thomson-Houston Co, Ltd, Rugby, England
CF—Clark Bros Co, Inc, Olean, New York (manufacture) and Frederic Flader, Inc, (design and development) N Tonawanda, N. Y., U.S.A.
DL—DeLaval Steam Turbine Co, Trenton, New Jersey, U.S.A.
E—Elliott Co, Jeannette, Pennsylvania
EE—English Electric Co, Ltd, Rugby, England
EM—Cie Electro-Mecanique, Le Bourget, Seine, France
EW—Escher Wyss Engineering Works, Ltd, Zurich, Switzerland
GE—General Electric Co, Schenectady, New York, U.S.A.
JB—John Brown & Co, Ltd, Clydebank, Scotland
M—Designs by Ernest Mercier and associates; builders unidentified
MV—Metropolitan-Vickers Electrical Co, Ltd, Trafford Park, England
O—Maschinenfabrik Oerlikon, Zurich
P—C A Parsons & Co, Ltd, Newcastle-upon-Tyne, England
PT—Design by Pametrada (Parsons and Marine Engineering Turbine Research and Development Association); components by various firms
R—Societé Rateau, Corneuve, France
RH—Ruston & Hornsby, Ltd, Lincoln, England
S—Sulzer Bros, Ltd, Winterthur, Switzerland
SM—Research and development by SEME (Societé d'Etude Mecaniques et Energetiques) and manufacture by SIGMA (Societé Industrielle Generals de Mecanique Appliquée) of Lyons-Venissieux, France
T—Turbomeca, Bordes par Pau, Basses Pyrenees, France
W—Westinghouse Electric Corp, Philadelphia, Pennsylvania, U.S.A.

1949 Design Survey of Long-Life Gas Turbines

Compiled by:
L. N. Rowley, Executive Editor

LOCATION AND APPLICATION	Builder	Status or date of initial operation	GENERAL CHARACTERISTICS: Name plate or rated capacity	Expected or maximum capability	Turbine inlet temperature, F	Pressure ratio	Cycle	Number of shafts	Shaft speeds, 1000 rpm	No. of turbine cylinders	No. of turbine cylinders in series	No. of compressor cylinders	No. of compressor cylinders in series	No. of intercoolers
EXPERIMENTAL AND SHOP UNITS:														
U. S. Naval Engrg Exp Station, Annapolis, Md.	AC	'44	-	3,500 hp	1500	4.0	O	2	5.18/5.18	2	0	1	0	0
Boeing Airplane Co, Seattle, Wash.	B	T	-	200 hp	1500	-	O	2	36.0/24.0	2	2	1	0	0
DeLaval Steam Turbine Co, Trenton, N. J.	DL	T	750 hp	-	1500	-	O	3	21.0/17.0/13.6	3	3	2	2	1
DeLaval Steam Turbine Co, Trenton, N. J.	DL	C	3,000 hp	-	1300	6.0	O	2	7.9/4.2	2	2	1	0	0
John Brown & Co, Ltd, Clydebank, Scotland	JB	'48	500 hp	-	1200	3.5	O	1	6.0	1	0	1	0	0
Brush Elec Engrg Co, Loughborough, England	BE	C	2,000 kw	-	1160	4.9	O	2	5.0/3.0	2	2	1	0	0
English Electric Co, Ltd, Rugby, England	EE	'44	150 hp	350 hp	1000	4.75	FP	1	10.0	1	0	-	-	-
Metropolitan-Vickers Electrical Co, Ltd, Trafford Park, England	MV	'49	2,000 kw	-	1200	3.5	O	2	7.3/5.0	2	2	1	0	0
C A Parsons Co, Ltd, Heaton Works, England	P	T	500 hp	-	1200	4.0	O	1	6.0	1	0	1	0	0
Pametrada (Experimental marine unit)	PT	-	3,500 hp	-	1200	5.5	O	2	4.5/3.08	2	2	2	2	1
Ruston and Hornsby, Ltd, Lincoln, England	RH	'49	1,100 hp	-	-	-	O	2	-	-	-	-	-	-
Escher Wyss, Ltd, Zurich, Switzerland	KW	'39	2,000 kw	-	1270	3.8	C	2	8.0/3.0	2	2	3	3	2
Maschinenfabrik Oerlikon, Zurich, Switzerland	O	'47	1,000 kw	-	-	4.0	O	2	4.5/3.0	2	2	3	3	2
Sulzer Bros, Ltd, Winterthur, Switzerland	S	'48	7,500 hp	-	1200	16	S	3	-	4	3	3	3	2
Sulzer Bros, Ltd, Winterthur, Switzerland	S	'45	7,000 hp	-	-	-	FP	-	-	-	-	-	-	-
Electricite de France, Vitry, France	M	T	1,000 hp	-	-	-	EP	-	-	-	-	-	-	-
Cie Electro-Mecanique, Le Bourget, France	EM	T	10,000 hp	-	1470	-	O	3	6.3/5 56/3.6	3	3	2	2	1
SEMA and SIGMA, Venissieux, Rhone, France	SM	'49	1,550 kw	1,700 kw	967	4.35	FP	1	-	-	-	-	-	-
Laboratoires Turbine a Gas, St Denis, France	T	'49	1,600 hp	-	1300		O	1	-	1	-	-	-	-
STATIONARY UNITS:														
Tennessee Gas Transmission Co, Moorehead, Ky	CP	B	5,500 hp	-	-	-	-	-	-	-	-	-	-	-
Huey Sta, Oklahoma Gas & Elec Co, Okla City	GE	'49	3,500 kw	3,500 kw	1400	6.0	O	1	6.7	1	0	1	0	0
Farmingdale Sta, Central Maine Power Co (n)	GE	'49	3,500 kw	4,375 h	1400	5.9	O	1	6.7	1	0	1	0	0
Bangor Hydroelectric Co, Bangor, Maine	GE	'50	5,000 kw	6,250 h	1500	9.0	O	2	7.2/8.7	1j	2	2	2	1
Public Service Co of Oklahoma (2 units)	GE	'50	5,000 kw	6,250 h	1500	9.0	O	2	7.2/8.7	1j	2	2	2	1
Mississippi River Fuel Corp pipeline (test)	W	'46	2,000 hp	2,000 hp	1350	5.0	O	1	9.2	1	0	1	0	0
Carolina Port Sta, N Scotland Hydro Bd	JB	'50	12,500 kw	-	1250	10	C	2	3.0/5.5	2	2	4	4	3
Trafford Sta, British Electricity Authority	MV	'50	15,000 kw	-	1200	10	O	2	3.0/5.5	2	2	2	2	1
Dunston Sta, British Electricity Authority	P	-	15,000 kw	-	1200	-	O	-	-	-	-	-	-	-
Nat'l Gas-Turbine Estab, Pyestock, England	P	-	10,000 kw	-	1200	-	O	2	-	-	-	-	-	-
Municipal Elec Supply, Neuchatel, Switz	BB	'39	4,000 kw	-	1000	4.0	O	1	3.0	1	0	1	0	0
Anglo-Iranian Oil Co, Agha-Jari, Iran (2 units)	BB	'48	4,000 kw	4,700 h	1100	-	O	1	3.8	1	0	1	0	0
Corporacion Peruano del Santa, Chimbote, Peru	BB	'48	4,000 kw	4,225 kw	1100	4.6	O	1	3.6	1	0	1	0	0
Filaret Station, Bucharest, Rumania	BB	'48	10,000 kw	12,000 kw	1100	-	O	2	-	2	2	2	2	1
Santa Rosa Sta, Lima Lt Pwr & Trwy Co, Peru	BB	'49	10,000 kw	-	1100	-	O	2	-	2	2	3	3	2
C A Venezolana de Cementos, Caracas (2 units)	BB	'49	1,650 kw	-	1100	-	O	1	-	1	0	1	0	0
Raymond Arcache & Co, Alexandria, Egypt	BB	'49	1,200 kw	-	1100	-	O	1	-	1	0	1	0	0
Beznau Sta, North East Power Co, Switz	BB	'48	15,000 kw	(k)	1100	-	O	2	-	2	2	3	3	2
Beznau Sta, North East Power Co, Switz	BB	'49	27,000 kw	(k)	1100	-	O	2	-	2	2	4	3	2
St Denis Sta, Electricite de France, Paris	EW	'49	12,500 kw	-	1250	10	C	2	8.5/3.0	2	2	4m	4	3
Weinfelden Sta, North East Power Co, Switz	S	'50	20,000 kw	-	1200	20	S	3	-	4	3	4	4	3
Electricite de France, Paris, France	M	'49	15,000 kw	-	-	-	EP	-	-	-	-	-	-	-
Rheims Sta, Electricite de France, Rheims	SM	'50	1,250 kw	1,400 kw	865	3.9	FP	1	9.0	1	0	-	-	-
St Denis Sta, Electricite de France, Paris	R	-	2,000 hp	2,500 hp	1300	3.5	O	1	3.0	1	0	1	0	0
LOCOMOTIVE UNITS:														
Locomotive Development Committee, Bituminous Coal Research, Inc.	AC	'49	4,100 hp	4,500 hp	1300	5.0	O	1	5.7	1	0	1	0	0
Atchison, Topeka & Santa Fe Railway Co	E	-	3,750 hp	4,000 hp	1275	3.93	O	1	6.34	1	0	1	0	0
General Electric Co, Schenectady, N. Y.	E	-	3,750 hp	4,250 hp	1275	3.9	O	1	6.34	1	0	1	0	0
Westinghouse Electric Corp, Phila (2 units)	GE	'48	4,800 hp	4,800 hp	1400	6.0	O	1	6.7	1	0	1	0	0
British Railways (Western Region)	W	'49	2,000 hp	2,000 hp	1350	5.0	O	1	-	1	0	1	0	0
Swiss Federal Railway	MV	'50	3,500 hp	-	1292	5.25	O	1	7.0	1	0	1	0	0
British Railways (Western Region)	BB	'41	2,200 hp	-	1100	-	O	1	5.2	1	0	1	0	0
Brown Boveri Corp (experimental unit)	BB	'49	2,500 hp	-	1112	4.0	O	1	5.8	1	0	1	0	0
MARINE UNITS:	BB	T	4,000 hp	-	-	-	O	1	-	1	0	1	0	0
U. S. Navy (2 units, vessels unidentified)) U. S. Maritime Commission (merchant vessel))	E	C	3,000 hp	3,400 hp	1400	5.6	O	2	3.79/3.6	2	2	2	2	1
Anglo-Saxon Petroleum Co, tanker "Auris"	BT	C	1,200 hp	-	1200	4.2	O	2	5.75/3.0	2	2	1	0	0
British Admiralty ("Captains" class frigate)	EE	C	6,000 hp	-	-	-	O	-	5.6	-	-	-	-	-
British Admiralty (Motor gunboat-MGB-2009)	MV	'47	2,500 hp	-	1382	3.47	O	2	7.25/3.6	2	2	1	0	0

SYMBOLS FOR STATUS
(Date of initial operation is given if known)
B-Order booked
C-Under construction
O-Operating
T-Under test

CYCLE
C--Closed cycle
EP-Equipressure cycle
FP-Free-piston cycle
O--Open cycle
S--Semiclosed cycle

COMBUSTOR TYPE
C-Special design for burning pulv coal
D-Double (Two combustors in parallel)
M-Multiple (Usually six or more combustors in parallel)
S-Single

COMPRESSOR TYPE
A-Axial
C-Centrifugal
L-Lysholm
M-Mixed-flow

FUEL TYPE
C--Pulverized coal
BO-Bunker C, or boiler oil
D--Distillate
DO-Diesel oil
GO-Gas oil
K--Kerosene
NG-Natural gas
O--Oil, unspecified

FOOTNOTES
a-Stated in cfm/hphr
b-Stated in lb/sec at design rating
c-Stated in lb/kwhr
d-Vortex blading
e-Stated in lb/hphr
f-Average at 1050-F inlet temperature
g-Btu per cu ft
h-With reduction in ambient temperature
j-L-p and h-p turbine in one casing
k-At 41-F ambient temperature
m-Two stages of centrifugal compression in one casing
n-Similar unit reported sold, unidentified
p-Compounded
*-Numbers in parentheses refer to issues of POWER in which descriptive articles appeared.

on Order, under Construction, or Operating

No. heating stages	Combustor type	Regenerator effectiveness, %	FUEL: Type	FUEL: Heating value, Btu per lb, net	PERFORMANCE: Thermal efficiency, %	PERFORMANCE: Work ratio	PERFORMANCE: Air rate, cfm per kwhr	TURBINES: No. impulse stages	TURBINES: No. reaction stages	TURBINES: Engine efficiency, %	TURBINES: Blade or disk cooling?	COMPRESSORS: Type	COMPRESSORS: No. of stages	COMPRESSORS: Discharge pressure, psia	COMPRESSORS: Compression ratio	COMPRESSORS: Compression efficiency, %	REMARKS*
1	D	60	DO	-	-	-	-	2	3	-	Disk	A	20	58.8	4.1	85.0+	Turbines in parallel. (5/46)
1	D	0	-	-	-	-	-	1	0	-	-	C	1	-	-	-	Turbines in series. Output speed 2500 rpm.
3	S	?	D	-	-	-	-	-	-	-	Disk	M	2	-	-	81	Marine design, reversible (10/46).
1	M	0	D	18,500H	17.6	-	-	0	5	-	None	M	3	-	6.0	-	Output turbine has 3 stages (4/49).
1	S	65	D	-	-	0.38	19.5	7	0	-	None	A	21	51.5	3.5	-	Designed by Pametrada.
1	-	0		18,600	17	0.26	24.7	2d	0	85	Disk	A	16	71.2	4.9	82	Turbines similar; both have stator cooling.
-	-	-	GO	18,350	40	-	-	-	-	-	-	-	-	-	-	-	
1	D	56	0	-	20.5	0.34	56.0b	1	0	87	Both	A	11	51.0	3.5	86	Power plant for M-V main works at Trafford Park
								0	4	86	-						
1	S	75	GO		15.6f	-	-	0	8	-	-	A	25	-	4.0	80-82	
2	S	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Components built by various firms.
-	-	-	-	-	-	-	-	-	-	-	-	A	-	-	-	-	
1	S	93	BO	18,288	31.5T	0.39	73C	6	0	90.3	-	A	7	-	1.6	-	I-p compressor has 9 stages; h-p has 13
1	S	?	0	-	-	-	-	-	-	-	-	C	3	-	4.0	88	(12/47)
2	S	30+	0	-	-	-	-	-	-	-	-	A	-	-	-	-	Closed part of cycle is 4:1. (5/46)
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(11/45, also 5/46).
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Test plant in Vitry steam station.
2	S	?	0	-	-	-	-	-	4	-	Blade	A	15	-	-	-	Only h-p elements survive Occupation.
-	-	-	GO	18,000	37.0		10.1	3	-	85	None	-	-	-	-	-	Output turbine built by Alsthom. (1/48).
-	-	-	K	-	-	-	-	2	-	86	None	-	-	-	-	-	Turbine only, supplied by compressed air.
-	-	-	-	-	30+	-	-	-	-	-	-	A	-	-	-	-	To drive pipeline compressor.
1	M	0	NG	1,000g	17	0.33		2	0	-	Yes	A	15	-	6.0	-	Exhaust heats feedwater. (9/48)
1	M	0	BO	17,400	17	-	94b	2	0	-	Yes	A	15	86.5	5.9	-	Replaces obsolete steam unit.
1	M	75	BO	17,400	28	-	72b	2	0	-	Yes	A	9	44.0	3	-	To supplement hydro system.
								1	0	-	-	A	11	128.0	3	-	
1	M	75	NG	1,000g	28	-	72b	2	0	-	-	A	9	44.0	3	-	
								1	0	-	-	A	11	128.0	3	-	
1	M	0	0	-	-	0.33	14.0a	0	8	86	No	A	20	75.0	5	84	Built and tested as locomotive prototype.
2	S	88	-	-	32.9	0.38		-	-	-	-	-	-	-	-	-	Under Escher Wyss license.
2	S	73.5	GO	18,540	28.0	0.34	230b	0	2p	-	-	A	14	46.6	3.25	-	
								0	6p	-	-	A	15	150.0	3.25	-	
-	-	75	D	18,500	-	-	-	-	-	-	-	A	-	-	-	-	
			O	18,500				-	-	-	-	A	-	-	-	-	
1	S	0	BO	18,257	18.0T	-	-	-	-	88T	None	A	-	61.9	4.4	84.6	See (2/40) for test data.
1	S	0	NG		18.0	-	-	-	-	-	None	A	-	-	-	-	Fuel gas expanded through separate turbine.
1	S	0	0	18,000	19.5T	-	-	-	-	88-89	None	A	-	-	4.6	88-90	Standby unit (4/47)
2	S	0	NG		23.5T	-	-	-	-	-	None	A	-	-	-	-	
2	S	?	BO		30.0T	-	-	-	-	-	None	A	-	-	-	-	Base-load unit
1	S	?	-	-	22.0	-	-	-	-	-	None	A	-	-	-	-	
1	S	?	-	-	23.0	-	-	-	-	-	None	A	-	-	-	-	
2	S	?	BO	-	30.5T	-	-	-	-	-	None	A	-	-	-	-	For winter backup of hydro system. Larger
2	S	?	BO	-	34.0	-	-	-	-	-	None	A	-	-	-	-	unit has double-flow 1-p turbine, compressor
2	S	90	BO	-	34.0	0.43	40c	-	-	-	-	A,C	-	-	-	-	Last two compressor stages are centrifugal
2	S	30+	0	-	-	-	-	-	-	-	-	A	-	-	-	-	For winter backup of hydro system.
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	-	-	GO	18,000	36	-	-	-	-	-	-	FP	-	-	-	-	
1	S	60	BO	18,000	-	-	-	-	-	-	None	A	-	-	3.5	-	
1	C	53	C	-	23.0	0.34	53e	0	6	-	Disk	A	20	70	4.9	84+	Chassis to be built by American Loco Co.
1	C	54	C	12,000	23.0	0.31	66.8e	0	4	88	None	C	2	57.8	3.93	79	Chassis to be built by Baldwin Loco Wks.
1	S	54	0	17,000	23.5	0.29	64.2e	0	4	88	None	C	2	57.4	3.9	79	" " " " " " " "
1	M	0	BO	17,400	17.0	0.33	-	2	0	-	Yes	A	15	-	6.0	-	Starting service tests on Union Pacific RR.
1	M	0	0	-	-	0.33	14.0a	0	8	86	None	A	23	75.0	5.0	84	Westinghouse 4000-hp demonstrator loco.
1	M	0	GO	18,540	20.3	0.35	52.5b	0	5	89	-	A	15	76.6	5.25	85	
1	S	?	0	-	17.6	-	-	-	-	-	-	-	-	-	-	-	Over 100,000 miles and 7000 hr service.
1	S	40	BO	17,400	-	0.25	-	0	-	-	None	A	-	58	4.0	-	
1	S	?	0	-	-	-	-	-	-	-	-	-	-	-	-	-	Unit has "Comprex" (8/46, 9/46)
2	S	76	DO	18,400	32.6	0.45	34.5e	0	10	87.1	None	L	1	40.5	2.8	83	
								0	10	88.5	None	L	1	81.9	2.04	83	
1	-	55	0	-	20.0	0.30	16.5a	0	7	86.0	None	A	24	61.5	4.2	82	Replaces one of four diesel units,
								0	6	85.0	None						for comparison tests
-	-	-	0	-	-	-	-	-	-	-	-	A	-	-	-	-	
1	M	0	GO	18,540	14.0T	0.4	47.5b	2	0	86	Disk	A	9	51.0	3.47	85	First gas turbine used at sea.
								0	4	88	-						

GENERAL NOTES

Temperature: For all but free-piston plants, this may be taken as the cycle temperature. For free-piston units it is temperature of gas exhausted from compressor to inlet of output turbine.

Pressure Ratio: This is approximate overall pressure-ratio for cycle. Pressure ratios for individual compressors are given under "Compressors".

Shaft Speed: Lack of space makes it impossible to identify the shafts.

Cycle Arrangement: By studying data on number of turbines, compressors, intercoolers, heating stages, etc. it is possible to form a good idea of cycle.

Regenerators: Where regenerator is used, but its effectiveness is not known, it is indicated by a question mark (?)

Heating Value: Heating value is net or lower value unless marked: 18,000H.

Thermal Efficiency: Where heating value is on lower basis, efficiency is also, and vice versa. Values are calculated unless indicated as test data: 29.5T.

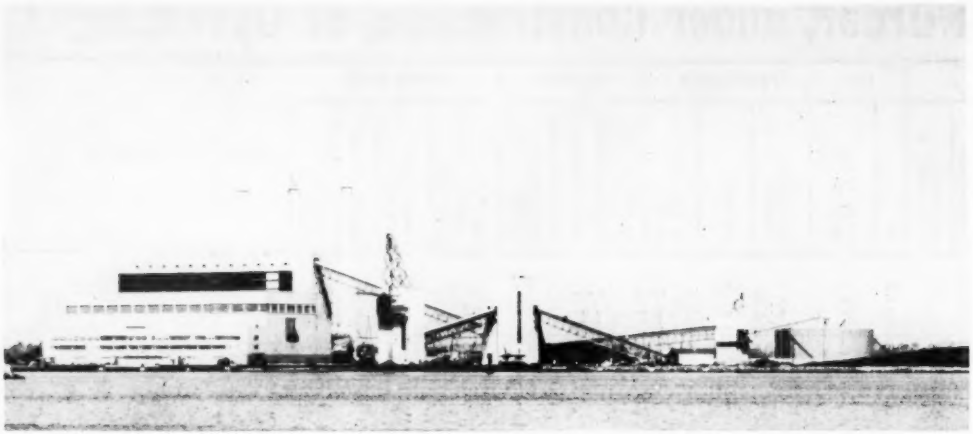
Work Ratio: Defined as ratio of cycle net work output to total work developed in turbine or turbines.

Air Rate: Amount of air entering compressor inlet per unit of cycle net output Units as designated (see footnotes).

Turbines, Compressors: Where plant includes more than one turbine or compressor, and they differ, listings are separate. Turbines are in order of descending pressure; first unit listed would be h-p turbine. Compressors are in ascending order; first listed would be l-p.

Engine Efficiency: Defined as ratio of work actually developed by turbine expanding hot gas through given pressure range to work that would be yielded by ideal adiabatic expansion.

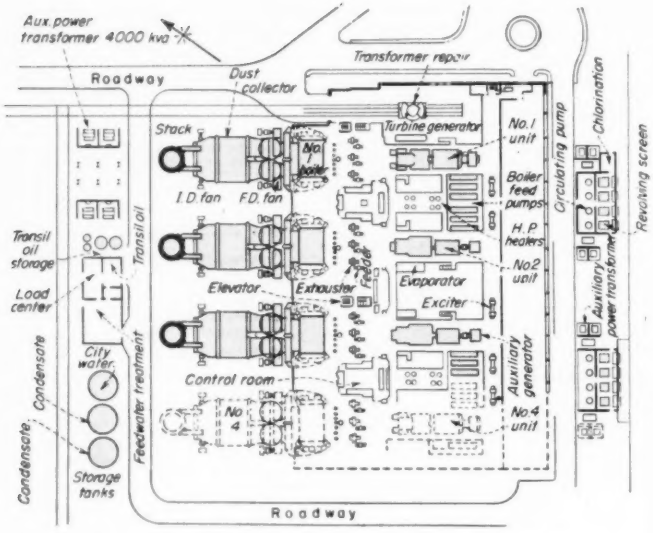
Compression Efficiency: Defined as work required for ideal adiabatic air compression through given pressure range to work actually needed for compressor.



1 Sewaren Generating Station now has third unit under construction; building will be extended for 4th unit, under design. Boilers fire either pulverized coal or oil. Circulating water for condensers comes from the Kill Van Kull, a tidal channel

SEWAREN Has Semi-Outdoor Layout,

Station will ultimately have four units using 1500-psig 1050-F steam. Last turbine will have reheat at 1000 F, three units are tandem-compound, triple exhaust. Economizers, air heaters, fans, dust collectors, boilers are outdoors*

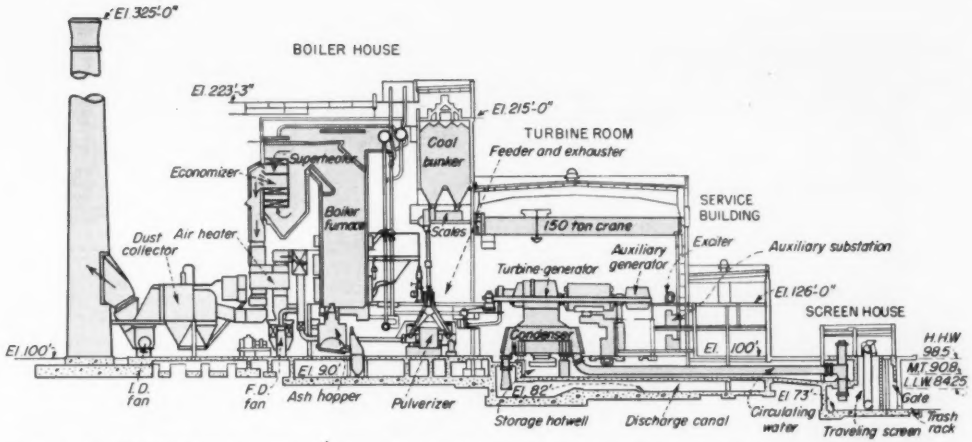


3 Upper part of boiler furnaces and following equipment are all outdoors. Each pair of units has one centralized control room. Units have separate m-g exciter sets

AT THE END OF NOVEMBER 1948, units No. 1 and 2—100,000 kw each, 1500 psig, 1050 F—started commercial operation at Sewaren Generating Station. Unit No. 3, a duplicate of No. 2, is scheduled to start in the fall of 1949. No. 4, 125,000-kw capacity, 1500-psig 1050-F initial steam with reheat to 1000 F, is now being designed and is expected to start in 1951. All four units run at 3600 rpm. Present estimated cost of the 4-unit station, including all electrical equipment to the high-voltage side of the transformers, is $132 per nameplate kw.

Design Features. The auxiliary equipment is laid out as near ground level as possible. Circulating-water pumps stand at the screen well. The fans, air preheaters, and dust collectors are outdoors. Stacks stand on separate foundations. The plant spreads out horizontally.

The building encloses the front and one side of each of the semi-outdoor boilers. This construction arrangement saved about a million dollars in initial cost of the first three units. The smaller building volume and reduced heat radiation in the boiler house eases the venti-



2 A single 850,000-lb-per-hr steam generator feeds each 100,000-kw turbine unit. Each turbine has 8 bleed points, supplying 8 feedwater heaters and one evaporator. Three low-pressure heaters are located in main-condenser steam inlet

Uses 1050 F.

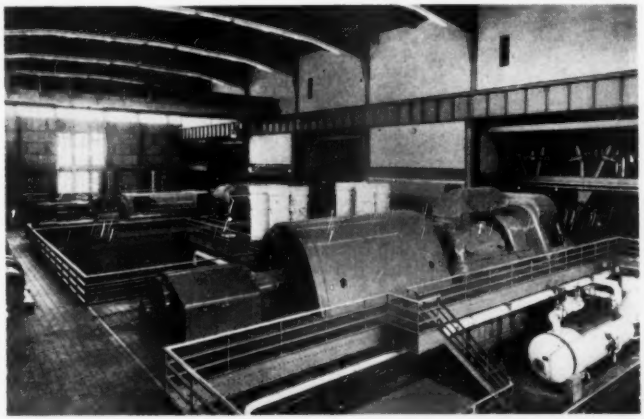
lating and cleaning problems in the plant.

Boiler overhauls will be scheduled for warm weather on an annual basis. The greater portion of maintenance work is done inside the furnace, gas passes and boiler drums. Furnaces and gas passes will be kept warm during winter shutdowns to aid maintenance work and prevent freezing the superheaters.

Fig. 7 gives the calculated plant heat rates for each of the units and also of Essex Unit No. 1, which largely served as a model for Sewaren. The Sewaren units each have eight bleed points, each supplying a feedwater heater. In addition, the third bleed point also feeds an evaporator. All eight heaters are closed, heater drains cascading back to the condenser deaerating hotwell. Condensate makes two passes through the re-entry type hotwell pump (1) when leaving the main condenser (2) after passing through condensate cooler, generator hydrogen and air coolers, oil and miscellaneous coolers and before entering the low-pressure heater-drain cooler.

The unit design with only one boiler per turbine facilitates centralized control. The two control rooms are T-shaped, the electrical bench board, Fig. 6, forming the cross bar of the T. The operator can see the two turbines under his control through the windows. Boiler, turbine and auxiliary control panels occupy the sides and rear of the rooms. The boilers can be seen through two windows at the rear. Of the three operators in each room, one controls the electrical bench board of two units, and each of the other two run the mechanical equipment of one unit. The operators are trained to handle both mechanical and electrical controls and, at present, each one rotates around the three jobs in the control room.

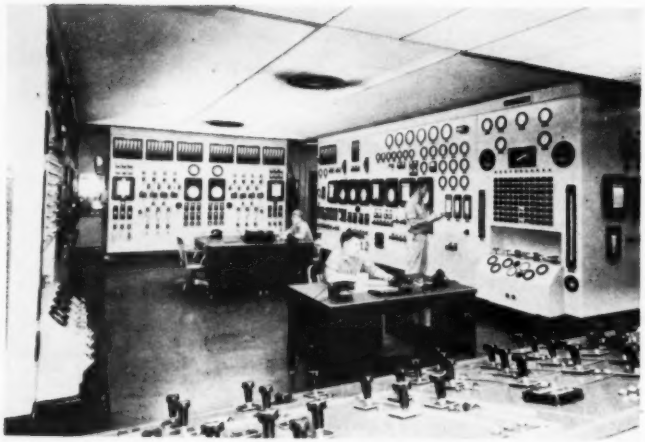
The rooms are air conditioned and soundproofed. Special attention was given the lighting, particularly of the vertical panels. These have totally indirect lighting from a cove and arched ceiling design. Vinylite eggcrate plastic in the areas between sections of the arched ceiling gives a luminous ceiling effect. This avoids high contrast between lighted and unlighted areas that a solid ceiling gives. Each control room is at the center of the area occupied by the equipment under its supervision.



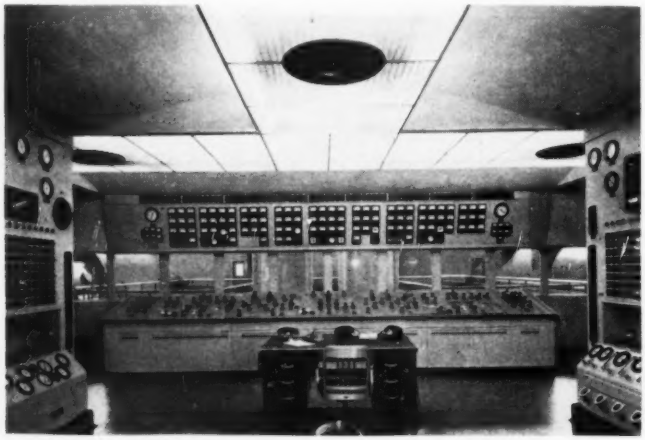
4 Units No. 1 and 2 have separate auxiliary shaft generators to supply their auxiliary drives. No steam-driven auxiliaries are used anywhere throughout the plant

High-Temperature Parts. Each unit has two welded joints between the austenitic steel of the stop valves and the ferritic steel of the steam piping. As stainless steel expands about 50% more than the chrome-moly in the range from 70 to 1050 F, there was some concern about the adequacy of a welded joint between the two metals in heavy wall thickness. With the cooperation of the boiler, turbine and pipe suppliers a

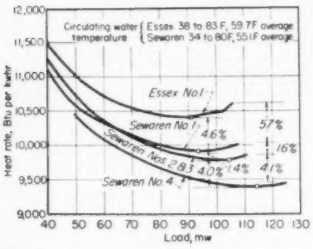
* Abstracted from "Design of Sewaren Generating Station and No. 1 Unit at Essex Station, Public Service Electric and Gas Co." by F. P. Fairchild, presented at San Francisco, Calif., Meeting of ASME, June 27-30, 1949



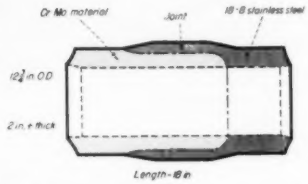
5 Centralized control room supervises two main units, mechanically and electrically. Boiler and turbine instrument panels are at sides and in back of the control room



6 Main electric bench board overlooks main turbine-room operating floor from the centralized control room. Note ceiling lighting for diffuse illumination on panels



7 Graph shows progressive improvement in plant heat rates with newer units



8 Special transition piece connects piping, valves of different steel alloys

cyclic heating test was made on several full-size heavy-wall welded pipe joints between austenitic and ferritic steels. The Kelcaloy transition piece finally selected is shown in Fig. 8. The major portion of the interface between the dissimilar metals being longitudinal to the pipe rather than transverse is subject to shear stress from internal pressure or bending. If failure occurs at the joint between the two metals it should appear as a lap or lamination rather than a separation straight across the pipe. The transition piece is welded to the stop valves in the shop, leaving the ferritic weld to be made in the field.

Spindles of the stop and control valves of No. 2 and 3 turbines are cooled with steam from the intermediate header of the superheater. No. 1 valves have no cooling arrangement.

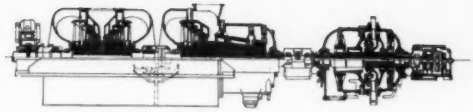
Auxiliary Power. Shaft-end auxiliary (or house) generators supply essential auxiliaries with energy free from outside disturbances. Normally each auxiliary generator carries the equipment of its own unit. The 2400-v auxiliary buses of each unit can be fed either from the generator or from auxiliary transformers connected to an outside source. The two are never paralleled. Relays throw over automatically from generator to transformer in case of loss of generator voltage. Manual throw-over in the other direction transfers auxiliaries to the generator after starting.

Auxiliaries. Steam from the high-pressure boilers goes to the main turbines only. All auxiliaries are electrically driven. Steam for heating fuel oil, mixing chemicals and heating the building normally comes from the evaporators. A heating boiler stands by in case of complete station shutdown. Every effort has been made to reduce makeup.

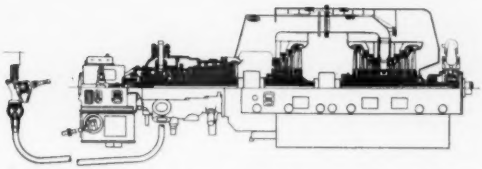
Motor-driven positive-displacement rotary vacuum pumps are used in place of the usual steam-jet air ejectors on the main condensers. Their advantages are: (1) sufficient capacity at low vacuum to eliminate starting evactors (2) adaptability to remote pushbutton starting and stopping (3) more complete removal of corrosive gases such as ammonia and CO_2 from the system since there are no inter- and after-condensers.

The traditional steam-driven auxiliary oil pump of the turbine-generator was replaced by a full capacity ac motor-driven pump backed up by a smaller dc motor-driven pump operating from the station battery. The latter has enough capacity to bring the turbine-generator to a stop if both main and auxiliary pumps fail.

Motors rated at 200 to 2000 hp are supplied at 2400 v, those between 25 and 200 hp at 440 v, and those below 25 hp at 220 v. These latter and the station lighting are supplied by air-cooled transformer load-center units



9 No. 4 unit will have h-p element exhausting to reheater, triple-flow l-p element taking 1000-F steam from reheater



10 No. 2 and 3 turbines are tandem-compound triple-flow 110,000-kw max, units using 1500-psig 1050-F steam

located throughout the station grounds.

Totally enclosed motors have been used to the greatest extent practicable. These include motors for the fans, coal-handling system, boiler-feed pumps, and the circulating pumps of No. 3 and 4 unit.

Buildings and Lighting. Architectural treatment of the buildings is simple and functional with strong horizontal lines formed by continuous rows of sash and glass block. At the permanent end of the turbine room there is a visitors' balcony giving an outside view of the property and an interior view of the turbine room. All the window sash are of aluminum and the principal entrance doors are of stainless steel. The turbine-room roof is supported by arched girders rather than by conventional open-truss construction.

High-level illumination is expected to result in better operation, safety and general housekeeping. In the turbine room, Fig. 4, combination incandescent-fluorescent units mount flush against the bottom flange of the roof beams to form continuous fixtures containing sixteen 500-watt incandescent lamps with control lenses and sixty-four 40-watt fluorescent tubes, about 10 kw of lighting per beam. Relamping and cleaning are done from the top of the crane.

For additional photographs, see page 106D

PRINCIPAL EQUIPMENT IN POWER PLANT

Units No. 1, 2, 3, Sewaren Station, Public Service Electric & Gas Co. Newark, N. J.

TURBINE-GENERATORS AND AUXILIARIES:

Turbine-Generator, 1.....Westinghouse Electric Corp
100,000-kw rated, 109,500-kw max, 1500-psig 1050-F throttle steam, 1.5 in. Hg abs exhaust, 3600 rpm, 32 stages 8 bleed points. Main generator rated 121,176 kva, 0.85 pf, H_2 press, 30 psig, 3 phase, 60 cycle, 13.1 to 14.5 kv star connected. Auxiliary generator 9375 kva, 0.8 pf, air cooled, 3600 rpm

Turbine-generators, 2.....General Electric Co
100,000-kw rated, 108,500-kw max, 1500-psig 1050-F steam, 1.5 in. Hg abs exhaust, 3600 rpm, 23 stages 8 bleed points. Main generator, H_2 cooled, 2 poles, 6 cycle, 3-phase wye for 13.8 kv. At 15-psig H_2 press, 111,765 kva at 0.85 pf, armature 4670 amp, field 1040 amp, exciter 250 v. At 25-psig H_2 press, 117,647 kva at 0.85 pf, armature 4920 amp, field 1070 amp. Auxiliary generator 9375 kva, 0.8 pf, air cooled, 3600 rpm

Surface condensers, 3.....Foster Wheeler Corp
One 50,000 sq ft, two 60,000 sq ft surface, single pass, divided water box, spring supported, welded steel shell, storage-type deaerating hot-well, ⅞-in.-OD No. 18-BWG aluminum brass and aluminum bronze tubes

Circulating-water pumps, 6.....Foster Wheeler Corp
Vertical, mixed flow, extended shaft, bottom suction, 47,000 gpm 17-ft total head, 345 rpm

Condensate and booster pumps, 6.....Worthington Pump & Mach Corp
Vertical, 4-stage reentry type, 2090 gpm at 517-ft total head, 884 rpm

Vacuum pumps, 6.....Kinney Manufacturing Co
Single-stage rotating plunger type, 550 cfm at 1.5 in. Hg abs

FEEDWATER SYSTEM:

Boiler feed pumps, 9.....Worthington Pump & Machinery Corp
Horizontal, barrel type, 8 stage, 1115 gpm at 4680-ft total head, 3465 rpm

Hydraulic couplings, 9.....American Blower Corp
2000 hp, sliding scoop, variable speed, 3550 rpm full speed

Condensate coolers, 3.....Graham Manufacturing Co
Horizontal, single pass, counterflow, 2560 sq ft

Feedwater heaters, 9.....Westinghouse Electric Corp
Horizontal, closed, 2 pass, low press, located in condenser neck

Drain coolers, 2 (for No. 2 and 3).....Westinghouse Electric Corp

Feedwater heaters, 3.....Foster Wheeler Corp
Vertical, closed, 4 pass, low press, internal drain coolers

Feedwater heaters, 12.....Foster Wheeler Corp
Vertical, closed, lock head, 2-pass, high press, desuperheat zone

Evaporators, 2.....Foster Wheeler Corp
Horizontal, single effect, 720 sq ft, 30,000 lb per hr

Evaporator, 1.....Griscom-Russell Co
Horizontal, 970 sq ft, 30,000 lb per hr

Evaporator deaerators, 3.....Worthington Pump & Machinery Corp

STEAM GENERATING UNITS:

Boilers, 3.....Combustion Engineering-Superheater, Inc
3-drum water-cooled furnaces, continuous slag tap, 850,000 lb per hr, 950,000 lb per hr for 4 hr, 1500 psig, 1050 F, 52,450-cu-ft furnace volume, 15,080-sq-ft heating surface. Three levels of combination coal and oil burners, vertically adjustable, tangential firing

Superheaters, 3.....Combustion Engineering-Superheater, Inc
2-stage pendant convection type, 41,800 sq ft, gas bypass superheat control

Economizers, 3.....Combustion Engineering-Superheater, Inc
Continuous tube, counterflow, 39,600 sq ft surface

Refractory walls, at superheater, economizer.....M W Detrick Co; George Allen & Son

Air heaters, 6.....Air Preheater Corp
Vertical-shaft regenerative 104,350 sq ft surface

Forced-draft fans, 6.....American Blower Corp
123,000 cfm at 80 F, 22 in. water, driven through 6 hydraulic couplings of continuous pump type, 600 hp, 1130 rpm

Radiators, 6.....Young Radiator Co
Air cooled, for cooling oil of the f-d fan hydraulic couplings

Induced-draft fans, 2 (Unit No. 1).....American Blower Corp
221,000 cfm at 321 F, 17.75 in. water, driven through 2 hydraulic couplings of continuous pump type, 1250 hp, 600 rpm

Induced-draft fans, 4.....American Blower Corp
221,000 cfm at 321 F, 17.75 in. water, louver-damper control

Radiators, 2, to cool f-d fan coupling oil.....General Electric Co

Insulation, boiler and gas ducts.....Johns-Manville Corp; H W Porter Co

Insulation, hot-air ducts.....Charles S Wood & Co

Soot blowers.....Diamond Power Specialty Corp
Automatic, sequential, pneumatically operated. Retracting units operate at 250 psig, air-puff units at 320 psig

Pulverizers, 9.....Foster Wheeler Corp
Revolving drum, ball mill, Hardinge, double feed and classifiers, 200 rpm, 37,400 lb per hr, table-type coal feeders, constant-speed exhausters running at 360 rpm

COAL-HANDLIING SYSTEM:

Coal unloading tower, 700 t per hr.....McKiernan-Terry Corp

Coal crusher, 600 t per hr hammermill.....Pennsylvania Crusher Co

Conveying equipment.....Robins Conveyors, Div of Hewitt-Robins, Inc
600-t-per-hr capacity, 8 conveyors, traveling tripper

Conveyor belting.....Thermoid Co

Magnetic separator.....Dings Magnetic Separator Co

Weightometers, 2.....Merrick Scale Manufacturing Co

Bunkers, 3, 1800 tons each.....Connery Construction Co

POWER-PLANT EQUIPMENT (CONTINUED)

Tractors, 2 — Caterpillar Tractor Co; Allis-Chalmers Manufacturing Co

Coal hoppers and chutes — Allied Steel Products Corp; Heilman Boiler Works

Coal gates in chutes and bunker — Stock Engineering Co

Vibrators — W Richard Witte & Co

Automatic coal scales, 12 — Richardson Scale Co

Fuel-oil heaters, 5 — Griscom Russell Co; Alco Products Div, American Loco Co

DUST AND ASH-HANDLING SYSTEM:

Dust collectors, 3 — Western Precipitation Corp
Each collector consists of 1 multiclone with 780 tubes and 1 Cottrell electrostatic precipitator with five units in one shell

Dust-conveying system — Fuller Co

Redler conveyors, precipitator to dust pump — Stephens-Adamson Mfg Co

Redler conveyor, variable-speed drives — Reeves Pulley Co

Screw conveyors, 3, economizer to dust pump — Link Belt Co

Rotary vane feeder equipment — United Conveyor Corp

Dust-storage silo — Heilman Boiler Works

Ash sluicing systems, 3 — Allen-Sherman-Hoff Co
100,000-lb storage hoppers, sump tanks, 2000-gpm pumps, ash de-watering and storage bins of 4000-cu-ft capacity

INSTRUMENTS, METERS AND CONTROLS:

Automatic combustion control
Automatic pressure controls
Automatic water-level controls
Automatic temperature controls — Hagan Corp

Automatic feedwater control — Bailey Meter Co
By boiler feed pump speed, 3-element type

Automatic superheater temperature control — Leeds & Northrup Co

Boiler meters, level recorders — Bailey Meter Co

Temperature, CO_2, pH, conductivity records — Leeds & Northrup Co

Remote boiler-water level indicators — Yarnall-Waring Co

Sight flow and water-level gages — Ernst Water Column & Gage Co

Boiler gage glasses — Diamond Power Specialty Corp

Pressure gages — Manning, Maxwell & Moore Inc

Indicating thermometers, draft gages, steam flow and pressure recorders — Republic Flow Meters Co

Manometers and liquid-level controllers — Moore Products

Industrial thermometers, vacuum columns — Taylor Instrument Cos

U-type manometers — Meriam Instrument Co

Automatic gage, fuel-oil storage — Johnston & Jennings Co

Liquid-level controllers — Fisher Governor Co

Level indicators, dust pump hoppers — Fuller Co

PUMPS:

Salt-water service pumps, 4 — DeLaval Steam Turbine Co

Sluice pumps, 3 — Worthington Pump & Machinery Corp

Fire pump, 1 — Goulds Pumps, Inc

Acid cleaning pumps, 2 — Worthington Pump & Machinery Corp

Condensate storage pumps, 2 — Ingersoll-Rand Co

City-water booster pump, 1 — Goulds Pumps, Inc

Sump pumps, 10 — Quimby Pump Div, H K Porter Co, Inc

Fuel-oil pumps, 3, rotary screw — DeLaval Steam Turbine Co

Condensate-return pump, 1 — Worthington Pump & Machinery Corp

Evaporator feed pumps, 3 — Goulds Pumps, Inc

Chemical feed pump, 1, triplex — Worthington Pump & Machinery Corp

AIR COMPRESSORS:

Control-air compressors, 4 — Ingersoll-Rand Co

Station-service compressor — Ingersoll-Rand Co

Soot-blower air compressors, 2 — Fuller Co

Soot-blower air compressors, 2 — Ingersoll-Rand Co

Dust-system air compressor, 1 — Fuller Co

Air driers, 6, dual tower silica gel for control air — Dehydraire Corp

PIPING AND VALVES:

Main steam and h-p boiler feed piping — M W Kellogg Co

Intermediate and l-p piping — Midwest Piping and Supply Co; Cornell & Underhill, Inc

Circulating water, 48-in. reinforced concrete — Lock Joint Pipe Co

Strainers — Andale Co; Leslie Co; Elliott Co

Rubber expansion joints — Moisson Packing & Rubber Co

Expansion joints — J Kopperman & Sons

Condenser tail pipes — Warren Foundry & Pipe Co

Control air copper tubing — Chase Brass & Copper Co

Steam traps — Yarnall-Waring Co

Acid-system lead-lined steel pipe — National Lead Co

Piping and duct insulation — Charles S Wood & Co

H-p steel gate and check valves — The Lunkenheimer Co

Steel gate and check valves — Wm Powell Co; Walworth Co

Safety valves — Manning, Maxwell & Moore, Inc; Foster Engineering Co

Bleeder check valves — Schutte & Koerting Co

Boiler blowdown valves — Yarnall-Waring Co

Regulating valves — Bailey Meter Co; Fisher Governor Co; Schutte & Koerting Co; Swartwout Co

Pressure-relief valves — Manning, Maxwell & Moore, Inc; Farris Engineering Co; Crosby Steam Gage & Valve Co

Iron valves — Crane Co; Chapman Valve and Manufacturing Co; Darling Valve and Manufacturing Co; Walworth Co

Circulating-water butterfly valves — Henry Pratt Co

Valve operators, air and electric — Philadelphia Gear Works

MISCELLANEOUS:

Water-storage tanks, three 125,000 gal each — Bethlehem Steel Co

Gland seal and drain tanks, 3 each — Heilman Boiler Works

Lubricating oil, condensate head and acid-cleaning-system storage tanks — McCarter Iron Works

Oil-storage tanks, air receivers — Buffalo Tank Corp

Air receiver, 1 — A O Smith Corp

Air receivers, 3 — Alco Products Div, American Locomotive Co

Condensate-return system — Gale Engineering Co

Lubricating-oil receiving tanks — Buffalo Tank Corp; Eastern Steel Tank Corp

Blowdown tanks, 3 — L O Koven & Brother, Inc

Chemical tanks — Bussler Metal Works; Buffalo Tank Corp

Caustic soda, sulphuric-acid tanks — Buffalo Tank Corp

Phosphoric acid tank — Derkiss Lead Burning Contractors

Turbine-room crane, 150 tons — Whiting Corp

Hoists and trolleys — Ingersoll-Rand Co; Philadelphia Chain Block & Co; Yale & Towne Manufacturing Co

Sluice gates, 6 — Coldwell-Wilcox Div, Krajewski Pesant Mfg Corp

Traveling water screens, 5, basket type — Link-Belt Co

Traveling water screen, 1 — Stephens-Adamson Manufacturing Co

Chlorination equipment — Wallace & Tiernan Products, Inc

Zeolite water softener — Worthington Pump & Machinery Corp

Oil-purifying equipment — DeLaval Separator Co

Capstan dock winches, 2 — Silent Hoist & Crane Co

Ventilation, air-conditioning systems — Buensod-Stacey, Inc

Ventilating fans, 5 — Buffalo Forge Co

Air filters — American Air Filter Co

Heating coils — American Blower Corp

Auxiliary ventilating fans — Henrickesen, Inc; Trane Co; American Blower Corp; American Machine & Metals, Inc

Elevators — Otis Elevator Co; Westinghouse Electric Corp

Heating boiler — Cleaver-Brooks Co

Heating-boiler deaerator — Worthington Pump & Machinery Corp

Heating and plumbing systems — F & W V Engelberger Co

Duplex sewage ejectors — Nash Engineering Co

Fire-protection equipment — CO^2 Fire Equipment Co; Walter Kidde Co; Grinnell Co; Smith Corp; Wirt and Knox Manufacturing Co; American LaFrance Foamite Co

ELECTRICAL EQUIPMENT:

Exciter sets, 3 — General Electric Co

Exciter set, 1 — Westinghouse Electric Corp

Main transformers, 4 — General Electric Co

Main transformers, 4 — Westinghouse Electric Corp

Auxiliary power transformers, 11 — Allis-Chalmers Mfg Co

Auxiliary power transformers — Moloney Electric Co

Oil circuit breakers, 9 — Westinghouse Electric Corp

Auxiliary-drive motors, 46 — Allis-Chalmers Manufacturing Co

Auxiliary-drive motors, 15 — General Electric Co

Auxiliary-drive motors, 40 — Westinghouse Electric Corp

Storage batteries, 2 — Electric Storage Battery Co

Metalclad switchgear — Westinghouse Electric Corp

220-v load centers, 10 — Westinghouse Electric Corp

220-v load centers, 14 — I-T-E Circuit Breaker Co

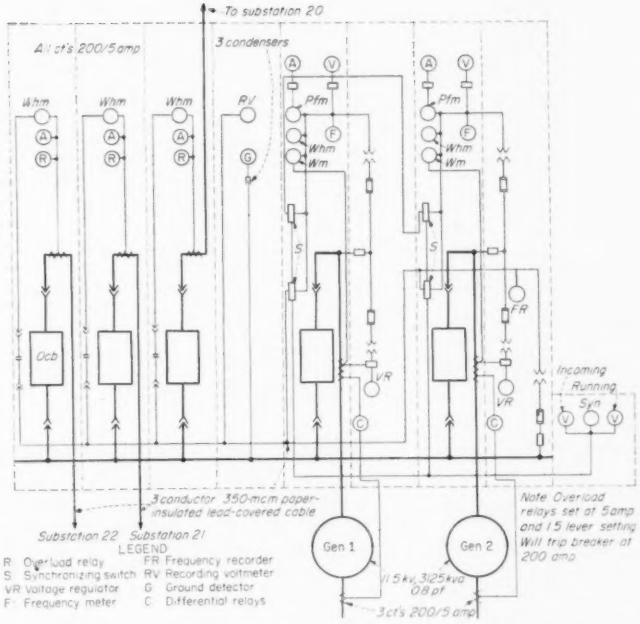
1 Bright surroundings result from liberal use of glass brick and windows. Low tension (440-v) switchgear can be seen peeking in at left with the 2.3- and 11.5-kv next in line. Original double-bus design accounts for depth of switchgear

Electrical Reliability Is Keynote In New 5000-kw Chemical Plant

Here's the electrical side of the new Charles Pfizer & Co power plant at Groton, Conn. Tie this in with the general plant story starting on page 72

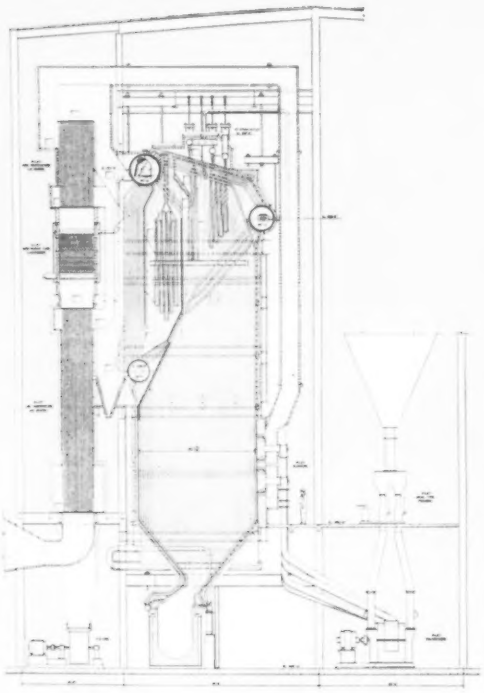
► PFIZER'S POWER PLANT is a fine example of modern electrical design with an eye cocked toward future power needs. It is set right on the shore of the Thames River on a site formerly occupied by the Electric Boat Co. Thought has been given to the day when added plant load might require greater generator capacity. When that day rolls around it is planned to knock out the far wall to make room for additional turbines and switchgear.

Electrical Layout. Two 11.5-kv 2500-kw turbine-driven generators form the nucleus of the plant's electrical system. Generator leads feed into enclosed switchgear, Fig. 3, containing 3-phase station bus and removable ocb's. Three 600-amp ocb's tap into this bus, each feeding the outdoor substations through 350-mcm paper-insulated lead cables.



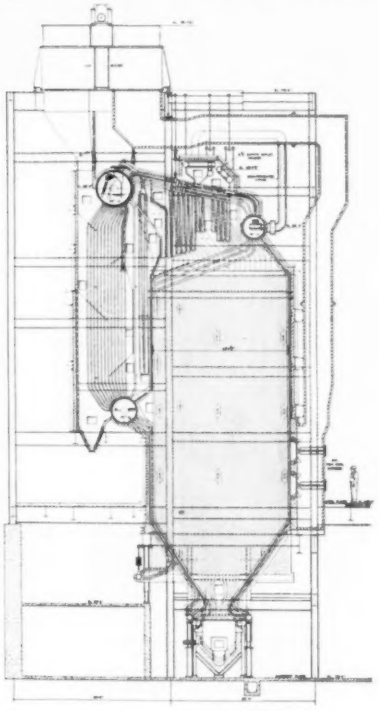
2 Here's schematic layout of 11.5-kv switchgear. Note that generator neutrals are ungrounded leaving the cable fault-finding to 3-phase static ground detector

A Few Recent RILEY



NORTHERN VIRGINIA POWER CO., Riverton Station
350,000 lbs. /hr. 1050 lbs. 900°F.
Sanderson & Porter, Engineers

PUBLIC SERVICE CO. OF INDIANA, Edwardsport, Ind.
400,000 lbs. /hr. 1000 lbs. 910°F.
Sargent & Lundy, Engineers
Public Service Co. of Indiana is also installing
Riley Units in their Dresser and Noblesville plants



All of these Public Utilities have recently ordered Riley Steam Generating Units

HOUSTON LIGHTING & POWER CO.
West Junction Station, 2—850,000 lbs. /hr.
Gable Street Station, 1—350,000 lbs. /hr.
Greens Bayou Station, 2—675,000 lbs. /hr.

CENTRAL OHIO LIGHT CO.
Bluffton Station, 1—120,000 lbs. /hr.

UPPER MICHIGAN POWER & LIGHT CO.
Escanaba Station, 1—150,000 lbs. /hr.

GULF POWER COMPANY
Pensacola Station, 2—230,000 lbs. /hr.

PUBLIC SERVICE CO. OF INDIANA
Dresser Station, 1—300,000 lbs. /hr.
Noblesville Station, 3—300,000 lbs. /hr.
Edwardsport Station, 2—400,000 lbs. /hr.

IOWA ILLINOIS GAS & ELECTRIC CO.
Davenport Station, 3—250,000 lbs. /hr.
Iowa City Station, 1—60,000 lbs. /hr.

INTERSTATE POWER CO.
Lansing Station, 2—120,000 lbs. /hr.
Fox Lake Station, 2—120,000 lbs. /hr.

WORCESTER COUNTY ELECTRIC CO.
Webster Street Station, 1—325,000 lbs. /hr.

RILEY

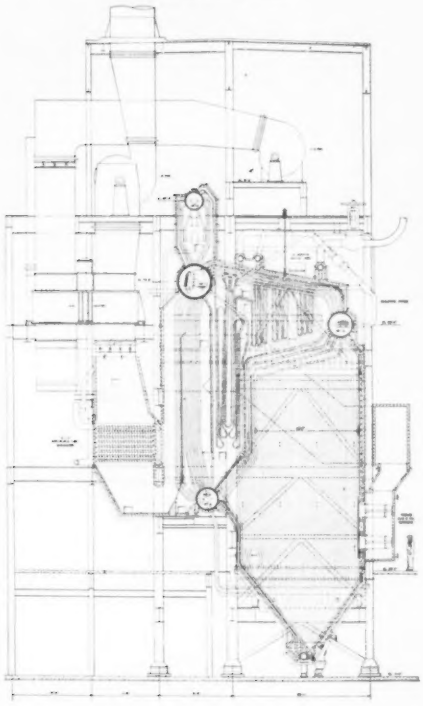
STOKER CORPORATION, WORCESTER, MASS.

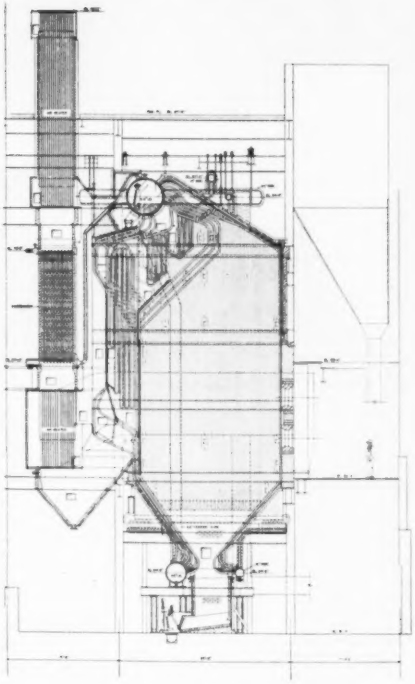
Boston · New York · Philadelphia · Washington · Buffalo · Pittsburgh · Cleveland · Detroit · Chicago
Cincinnati · Atlanta · New Orleans · Memphis · St. Louis · Kansas City · St. Paul · Tulsa · Houston
Denver · Salt Lake City · Los Angeles · Portland · Seattle

BOILERS · PULVERIZERS · BURNERS · STOKERS · SUPERHEATERS · FLUE GAS SCRUBBERS

Central Station Units

CITY OF LOS ANGELES, CALIF., Harbor Steam Plant
825,000 lbs./hr. 1200 lbs. 900°F.
With the addition of these three units,
Harbor Steam Plant will have 3,825,000 lbs. of steam
capacity of Riley Units





CENTRAL ILLINOIS LIGHT CO., Peoria, Ill.
(Commonwealth & Southern Corp.)
300,000 lbs. hr. 925 lbs. 900°F.
With the installation of these two units, Central Illinois
Light Co. will have four Riley Steam Generating Units in
this station

OTTER TAIL POWER CO.
Devils Lake Station, 1—75,000 lbs. hr.
Crookston Station, 2—75,000 lbs. hr.
Wahpeton Station, 1—100,000 lbs. hr.
Hoot Lake Station, 1—160,000 lbs. hr.

SOUTHWESTERN PUBLIC SERVICE CO.
Borger, Texas, 1—330,000 lbs. hr.

NEW ORLEANS PUBLIC SERVICE CO.
Market Street Station, 1—330,000 lbs. hr.

SOUTH CAROLINA POWER CO.
Charleston Station, 2—230,000 lbs. hr.
1—310,000 lbs. hr.

CENTRAL ILLINOIS LIGHT CO.
Peoria Station, 2—300,000 lbs. hr.
1—600,000 lbs. hr.
Springfield Station, 1—125,000 lbs. hr.

ARKANSAS POWER & LIGHT CO.
Cecil Lynch Station, 1—650,000 lbs. hr.

UTAH POWER & LIGHT CO.
Orem Station, 1—450,000 lbs. hr.
Jordan Station, 1—620,000 lbs. hr.

MISSISSIPPI POWER CO.
Hattiesburg Station, 3—230,000 lbs. hr.

OHIO EDISON CO.
Mad River Station, 1—250,000 lbs. hr.
Beech Street Station, 1—90,000 lbs. hr.

NORTHERN VIRGINIA POWER CO.
Riverton Station, 1—350,000 lbs. hr.

CITY OF LOS ANGELES
Harbor Steam Station, 3—825,000 lbs. hr.

UNION ELECTRIC CO. OF MISSOURI
Ashley Street Station, 3—310,000 lbs. hr.

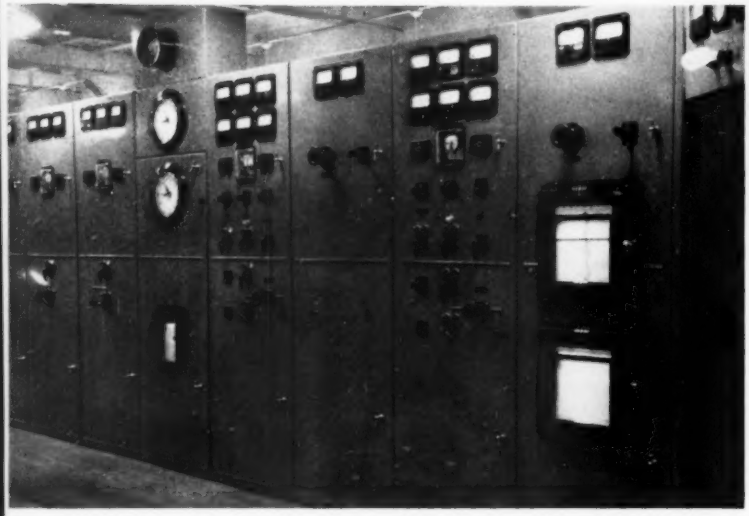
WEST PENN POWER CO.
Milesburg Station, 2—210,000 lbs. hr.

A survey of your Power Plant by a consulting engineer will possibly show ways of making surprisingly large savings in your power costs

COMPLETE STEAM GENERATING UNITS

. . . it will pay you to visit modern Riley Installations before purchasing Boiler or Fuel Burning Equipment

ECONOMIZERS · WATER-COOLED FURNACES · STEEL-CLAD INSULATED SETTINGS · AIR HEATERS



3 Closeup of the 11.5-kv switchgear. Two clocks near center used for frequency check on plant system. One clock ties in with Western Union, other with plant

4 Each oil breaker can be removed for maintenance after lowering on dolly

Feeders double back on their tracks from the secondary of the substation transformers right outside the power plant. These feeder voltages are 2.3 kv and 460 v, each tying into the remaining two switchgear blocks to the left of the 11.5-kv bus housing. Once again, removable type ocb's tap into the 2.3 kv and the 460-v buses to feed station auxiliaries and compressor house in addition to 2.3-kv feed back to the adjacent substation.

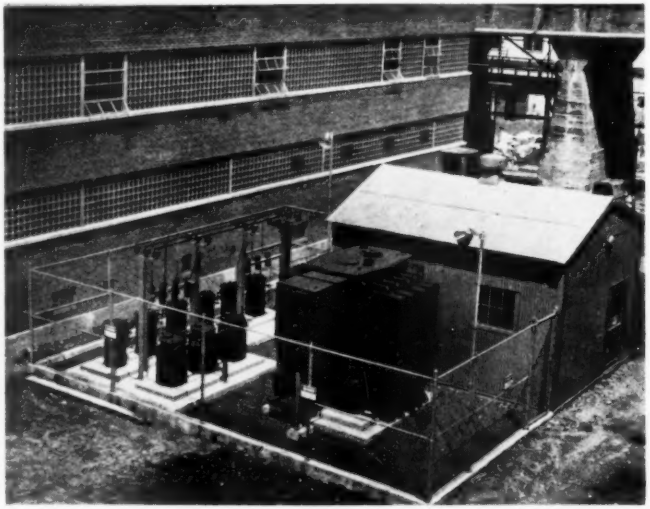
Hinged-cover metal-enclosed deadfront switchgear within the plant is divided into three sections: 11,500-, 2300- and 460-v. Both potential and current transformers are located within the structures with meters and instruments shown in Fig. 2, 5, 8 on the hinged doors. Although the switchgear was originally designed for double-bus operation the front bus only is used at present. Each of the substations have similar switchgear housed in a corrugated-metal switch house.

Plant Lighting. Glass-brick and large windows take away the gloomy look that went hand in hand with the power plants of yesteryear. And good lighting is maintained around the clock with high-bay 750-watt fixtures. A quick check on lighting level showed 30-ft candles on the turbine aisles with 35-ft candles in front of switchgear and 28 near boilers. Each lighting and plant-distribution panel carries a stenciled sign on its cover, telling where the other end of feeder terminates.

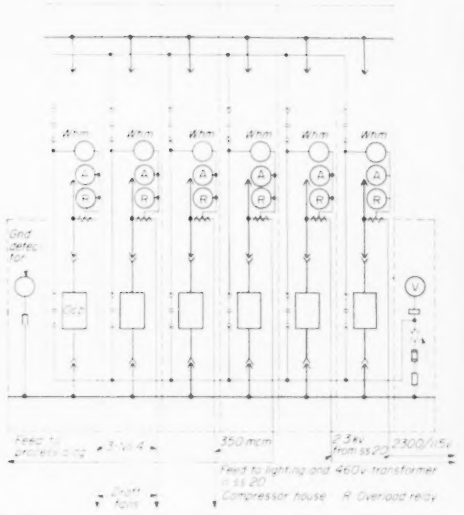
Smokestack is lighted with spotlights at roof's corners. These stack lights are controlled by photoelectric cell and time switch, working in conjunction.

Relay Protection. Each generator is protected by differential relays against any winding fault within machine or generator leads. All feeders from the switchgear are protected by overcurrent relays on two phases. It's worthwhile mentioning at this point that the complete electrical system is ungrounded: that is to say, all but the low tension 120/208 v.

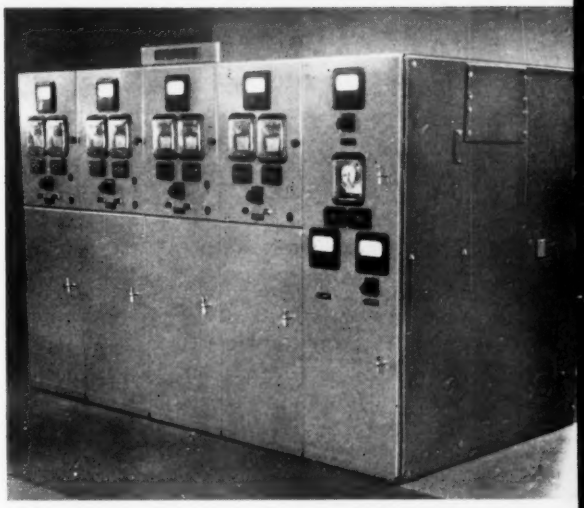
Grounds on any phase can be picked out with the 3-phase static ground de-



7 This transformer substation, one of three, is located right outside the power plant. Six 150-kva transformers in background are for 120/208-v plant lighting



5 Schematic of 2.3-kv switchgear located on machine floor. All cables entering and leaving have a neoprene covering

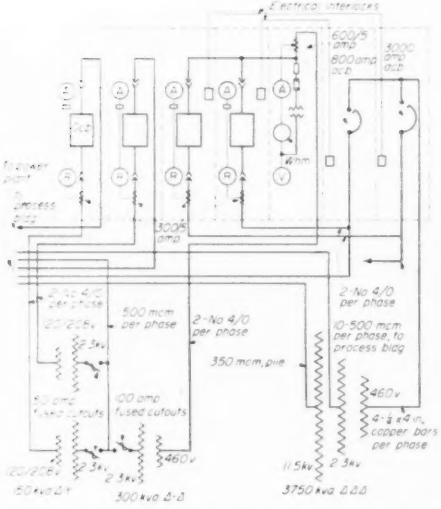


6 Test blocks, below overcurrent relays on 460-v switchgear above, simplify the periodic check on both relays and ct

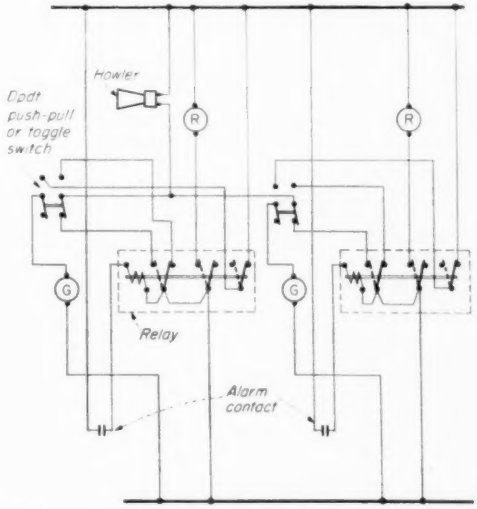
tector located on front of 11.5-kv switchgear. Since generator neutral is ungrounded an accidental ground on any one phase will not disturb the system. All 2.3-kv and 460-v cables are neoprene covered while 11.5-kv cables, except generator leads, are paper insulated, lead covered.

Speaking of grounding, a common equipment ground bus runs around the plant tying in with three separate grounding points in the nearby Thames River. In addition, the smokestack is topped with lightning rods connecting to a permanent river ground through No. 4/0 cable.

Operator on watch can keep a close check on frequency through a clock on the 11.5-kv switchgear that's tied in with Western Union. Along with it is a similar clock fed off the plant electrical system. In addition, a recording frequency meter keeps a running record of system frequency.



8 This is schematic of the substation in Fig. 7. Switchgear on top is housed in corrugated-metal covered switch house



9 Trouble in one of the outlying buildings sets off howler and red light on panel near switchboard in power plant

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

"DUST STORM". Abrasive dusts sprayed on the Type F, while operating at full speed, for extended periods, fail to impair operation. In these tests, none of the abrasive entered the bearing housing . . . governing and overspeed-trip mechanisms continued to operate freely.

Defies dust and dirt

The Type E Turbine is built for tough service. You can depend on this new general-purpose steam drive for the kind of service you want . . . *whenever* and *wherever* you want it. Whether you use the Type E for continuous or stand-by duty, you'll get smooth, reliable power.

Prolonged exposure to abrasive dusts or accumulations of sludge fails to more than dirty up the outside casing. Bearing seals are positive . . . keep oil in and filth out. No foreign matter can enter bearings or cylinder. There are no close-sliding fits to become jammed. Corrosion is avoided by liberal use of corrosion- and erosion-resisting materials throughout interior and exterior mechanisms. The governor-control linkage is always free to move, even when heavily covered with dust and dirt.

Exposure protection is but one of the important features of Type E Turbines. Wrapped up in one *standard* unit are the best features of previous Westinghouse mechanical drives, plus refinements and new developments that add up to greater economy and dependability. Sizes are available from 5 to 1,500 hp.

We invite your comparison . . . on *any* count. Get the facts from your nearby Westinghouse office, or write for 20-page booklet B-3896. Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

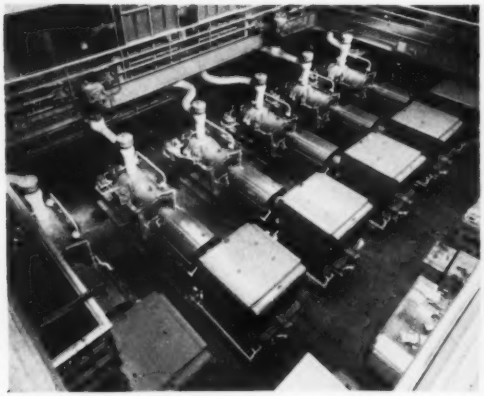
J-50500

Westinghouse

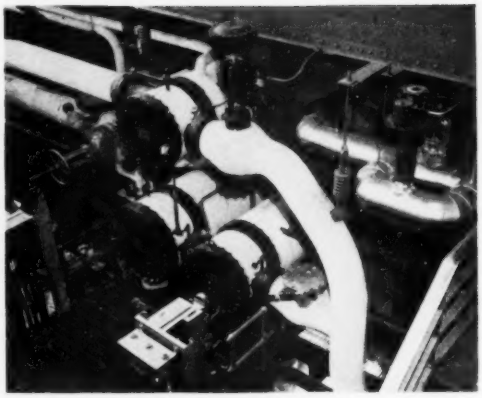
TYPE E

Turbines

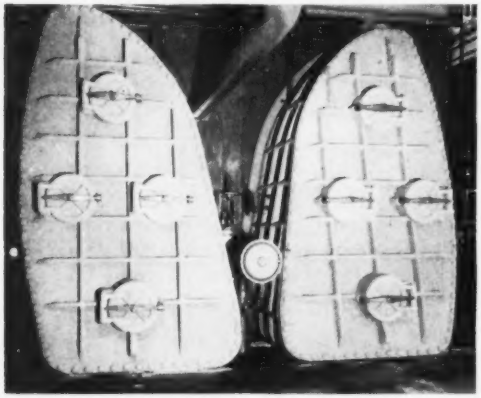
SEWAREN STATION VIEWS (CONTINUED FROM PAGE 102)



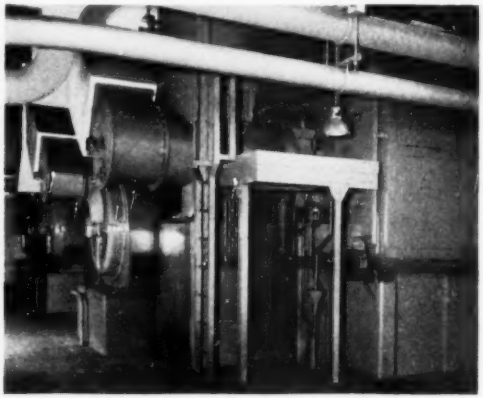
11 Totally enclosed motors drive boiler-feed pumps through variable-speed hydraulic couplings of sliding-scoop type



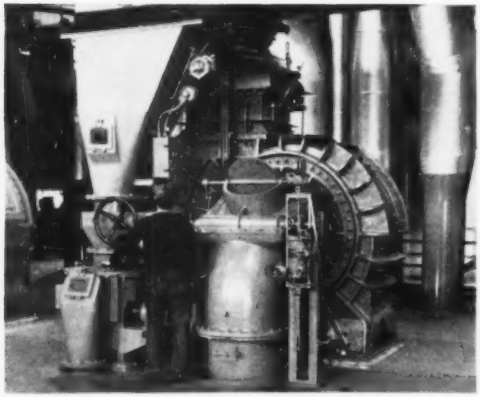
12 First three low-pressure heaters of each unit are located in condenser neck to shorten steam connections, use space



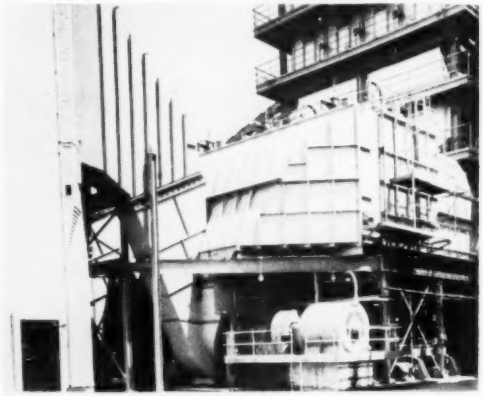
13 Main condensers of all units deaerate condensate and heater drains returning to boiler. Rotary pumps remove air



14 Three 37,400-lb-per-hr revolving drum ball mills serve each steam generator, 98% through 50 mesh, 200-rpm



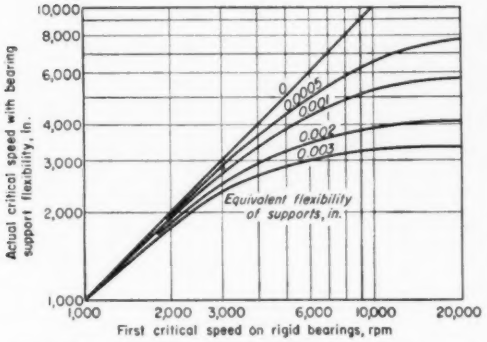
15 Table-type feeder and 360-rpm constant-speed exhauster serve each of the nine pulverizers in the boiler basement



16 Induced-draft fans and combination mechanical-electrical dust collectors stand outdoors adjacent to 225-ft stack

LETTERS FROM A TURBINE SPECIALIST—3

By E W BURSTADT and F H VAN NEST, *Turbine Division, General Electric Co*



TURBINE-SHAFT CRITICAL SPEED depends on flexibility of the bearing supports as well as on the shaft characteristics

BUILDER CHOOSES CRITICAL SPEED

Turbine Specialist
District Office

Dear Mr Specialist,

I want to be sure that the new turbine-generator set we are going to buy will be a smooth-running unit. Can I ensure this by specifying that the critical speed of the turbine must be a certain amount above the running speed?

Sincerely yours,
ENGINEER

Dear Mr Engineer,

Specifying a minimum critical speed for a turbine to be designed is much like ordering a chair and assuming it will be comfortable because a certain length of leg has been specified. Other factors must be taken into account if we are to end up with a smooth-running, efficient and reliable turbine-generator set in which you are interested.

Experience over the past 25 years has proved beyond doubt that, when properly designed and balanced, a turbine rotor will operate just as smoothly above its critical speed as below.

The accepted procedure for calculating critical speeds assumes that the shaft is supported in absolutely rigid bearings. Under this condition, the critical speed is entirely a function of the amount the shaft deflects from its own weight. In operation, however, the critical speed always falls below the calculated value because of flexibility in the supports. The amount it falls can be expressed in terms of equivalent additional deflection of the shaft as shown in the chart. For example, a shaft with a calculated critical of 6000 rpm would have an actual critical of 3000 rpm if the support flexibility were equivalent to 0.003-in. additional deflection of the turbine shaft.

In actual practice criticals are depressed by amounts corresponding to from 0.001- to 0.002-in. equivalent-support flexibility. Sometimes the range is a little greater.

Most turbines today running at 3600 rpm or more have their actual critical below running speed even though many of them have calculated criticals 20% above running speed. By assuming 0.001- to 0.002-in. equivalent-support flexibility the chart shows that this should be expected. The chart also shows that with 0.003-in. equivalent flexibility it is impossible to have an operating critical above 3400 rpm even if the shaft were infinitely stiff. From this chart we can see the impracticability of trying to build high-speed turbines with actual operating criticals above running speed.

Since critical speed is not a complete and reliable criterion of shaft design, other factors govern the proportions of the turbine shaft. There are a number of these, and since some of them tend to work at cross purposes, the acceptable design usually achieves the best balance between the conflicting factors. For example, the smallest possible shaft gives the smallest packing leakage and least loss in efficiency as the packing wears. The smaller the turbine, the more important this factor becomes, since for small turbines the packing leakage is an appreciable part of the total steam flow.

Another advantage of small shafts is that, when running above critical speed, a packing rub tends to heat the shaft so as to bow it away from the rub, minimizing packing wear and vibration.

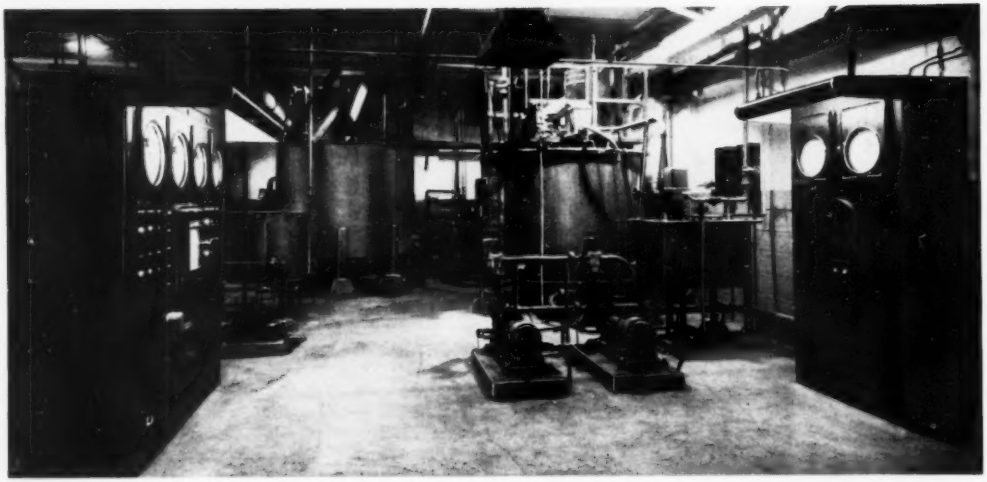
On the other hand, if the shaft is too small in diameter it becomes difficult to balance with ordinary equipment. Also, if the actual operating critical is less than half the operating speed, specially designed bearings may be necessary to prevent the bearings themselves from stimulating a vibration.

It's quite obvious that the best criterion for shaft design on small and medium-sized turbines for normal applications is to keep the shaft as small in diameter as is consistent with good mechanical operation. Naturally, you will want good over-all performance as well as smooth operation. But when specifying a high critical speed a large-diameter shaft becomes mandatory and often jeopardizes the over-all performance of the turbine unnecessarily. Bending and torsional stresses also determine shaft size, but they seldom become limiting factors.

The generator, which will be coupled to your turbine, is a 2-pole high-speed unit, built to operate above its critical speed. This is the usual construction since the rotor design is such that short, large-diameter rotor would be required to bring the calculated critical above the operating speed. This would not be the best design from an efficiency or cost standpoint.

The weight of evidence indicates that turbines should be designed to operate above critical speed, but this is only one of the many factors that must be taken into account in their design. If you desire further information on this subject please let me know.

Yours truly,
TURBINE SPECIALIST



FEEDWATER OPERATING FLOOR. The control panel, feedwater pumps and suction tank for sodium sulphate, phosphate mixing tanks, proportioning pumps, sulphuric-acid mixing tank, constant-head tank, other equipment are installed on this floor

Canada's Largest Steam Plant Reports On Five Years' Feedwater Experience

Feed treating conditions the water for five high-pressure boilers using 65-80% makeup. They need cleaning only once in ten months. A 1,000,000-lb-per-hr feed pump, opened after five years, showed no signs of internal scale or corrosion

By **JAMES E LEWIS**, *Feedwater Supervisor, Polymer Corp*

► FIVE RADIANT-TYPE BOILERS can produce 1,540,000 lb of 430-psi 650-F steam per hr at the steam and power plant of Polymer Corp, the Canadian government's manmade-rubber plant. Over 65 to 80% of the feedwater for these boilers is makeup produced from St. Clair River water. Because its organic material and oil contamination become high at times, the feedwater-treating system is the plant's most important feature.

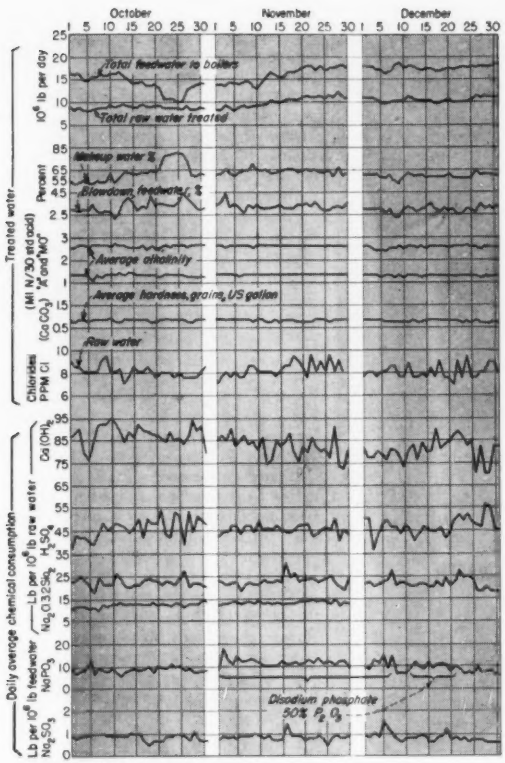
An external hot-process lime-soda softening system, followed by filtration, acid feed, deaeration, soda-sulphite injection and sodium-hexametaphosphate feed, was selected as best suited to boiler and process needs. Five years' operation may be of interest.

Plant Operation. Semi-automatic water-softening system has 1,600,000-lb-per-hr capacity. With an estimated 5% blowdown and not over 10% condensate return this system can supply six 308,000-lb-per-hr steam generators (POWER, March and April 1947).

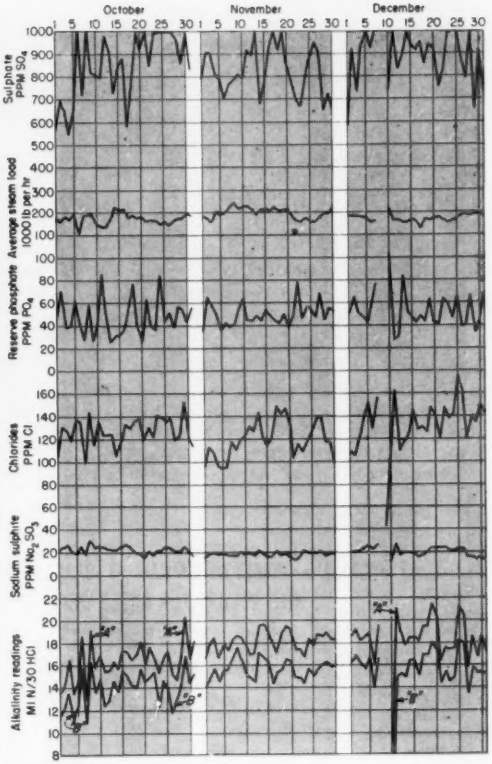
Junior stationary engineers operate the system to produce a practically consistent feedwater hardness of 13 ppm as $CaCO_3$ at the softener discharge. Raw St. Clair water, after passing through the continuous blowdown heat exchangers, goes to twin water softeners. Treated water passes to anthracite filters for clarification and is pumped to the two 800,000-lb-per-hr deaerating heaters. Return condensate is also pumped to the deaerators and mixed with the feedwater at the vent-condenser inflow. Steel deaerator storage tanks are large enough for 8-min retention time at maximum load. From the deaerators, feedwater is pumped through stage heaters to the boilers.

Hydrated lime ($Ca(OH)_2$) and soda ash (Na_2CO_3) are mixed separately in steel tanks with raw water to obtain 2.5% and 1.75% solutions, respectively. Sodium silicate (water glass—$Na_2O.3.2SiO_2$) is mixed with the soda-ash solution to form 0.5% thereof. Sulphuric acid (98% H_2SO_4) is mixed with raw water to form a 2.5% solution, and is further reduced to less than 1% with condensate before going to the deaerator inflow line. Sodium sulphite (Santosite—Na_2SO_3) is fed after deaeration and before the boiler-feed pump suction in a 1.5% solution. Sodium hexametaphosphate (Hagan) is fed directly to each boiler steam drum in a 2.5% solution.

St. Clair water at the plant intake is fairly consistent in quality and so an analysis, given in Table I, is made only occasionally. Oil and organic matter, present in varying amounts, are completely removed during softener process.



SOFTENER-OPERATION FORM for plotting the total raw water treated, the percent blowdown, and makeup and chemicals used



BOILER-WATER FORM gives a graphic record of boiler-water analysis and average load and a record of water treatment

Softener Operation. This is controlled from the analysis of the softener discharge. "A" reading ("P" or phenolphthalein alkalinity is the general term) and "MO" or methyl orange reading (brom-cresol green and methyl red mixed indicator is used to take advantage of a more distinct endpoint) are found by titrating with normal thirtieth hydrochloric acid. "H" or soap-hardness test is found by using Hagan standard soap solution, which has a constant 0.1 lather factor. This is a specially prepared soap reagent having a factor of 1 ml = 17.1 ppm $CaCO_3$ on a 50-ml sample.

Formulas 2A — MO and 2(MO — A) — H are used to control respectively the lime and soda-ash feed to the softeners. Lime feed for this system is controlled by maintaining the 2A — MO result between the range of — 0.3 and + 0.3. If formula result is higher than + 0.3, lime is decreased, if below — 0.3, lime is increased.

Generally, it is possible to maintain the result within the desired — 0.1 to + 0.1 ml range. Soda ash as determined by formula 2(MO — A) — H has to be maintained above 0.8 ml and held as high as possible to obtain low hardness, but still not so high as to increase boiler-water alkalinity above that desired.

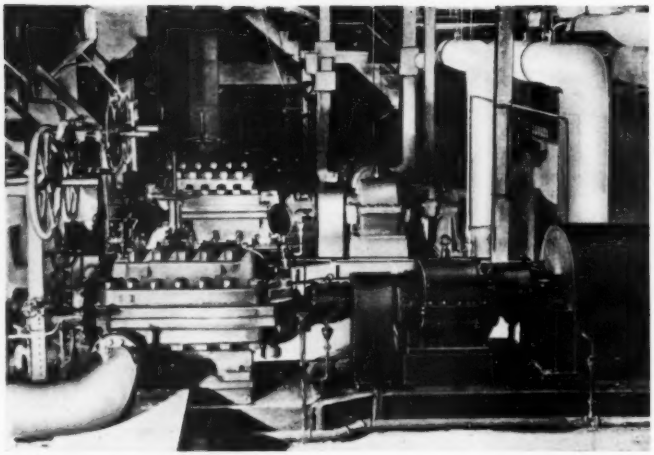
With sufficient excess soda this system can reduce raw-water hardness to 10 ppm calculated as $CaCO_3$. If this is done, however, more acid is automatically fed to reduce the higher alkalinity. This, in turn, causes solids to exceed maximum permissible limits for boiler-water total solids, necessitating greater blowdown and thereby offsetting any economical gain.

Softened Water Analysis. The ideal softener discharge analyses desired are: "A" reading equal to half or slightly higher than half "MO" reading, and "H" reading 0.7 to 0.8 ml. These conditions produce an all-carbonate, or carbonate-and-low-hydroxide alkalinity water, free of bicarbonate alkalinity at softener discharge.

Chemical feed to softeners is controlled by an electrically operated proportioner. A recording flowmeter with integrator contacts provides an impulse to a program timer at intervals of 5% of total softener rated capacity: 5000 gal. The timer in turn acts to energize the lowering motor to operate at the set number of minutes to feed solution by lowering a decanting pipe within the chemical tanks.

Continuous operating centrifugal pumps, equipped with orificed bypass lines, feed the solution to the surface of the softener water. Setting of the timers is based on analysis of filter discharge. With experience, operators can set the timers to control the softener to maintain fairly consistent end results.

Sulphuric acid is fed automatically to the treated water after filtration to maintain pH 8.6, (lowering it from pH 9.5 to 10.5). Lowering the pH is necessary to prevent precipitation of any calcium carbonate remaining in the feedwater during its passage through the stage heaters' tubes where temperature is increased from 250 to 340 F.



HIGH-PRESSURE FEED PUMPS. One of two 6-stage 1,000,000-lb-per-hr feed pumps. Opened after five years' service, it showed no sign of internal scale or corrosion

TABLE I—ANALYSIS OF RAW ST. CLAIR RIVER WATER AND FEEDWATER AFTER DEAERATOR

		Raw water from St. Clair River		Feedwater after deaerator	
		ppm	epm	ppm	epm
pH		7.7		9.0	
Hydroxide	(OH)	0	0.00	0	0.00
Carbonate	(CO_3)	0	0.00	10	0.33
Bicarbonate	(HCO_3)	98	1.60	0	0.00
Sulphate	(SO_4)	20	0.42	15	0.31
Chloride	(Cl)	5	0.14	1	0.03
Silica	(SiO_2)	3	0.00	1	0.00
Calcium	(Ca)	26	1.30	2 (filtered)	0.10
Magnesium	(Mg)	9	0.74	0.3	0.02
Suspended solids	Est	12-15		2-4	
Hardness as $CaCO_3$	Total	102	2.04	6	0.12
Calcium (Ca)	Total			4	0.20
Magnesium (Mg)	Total			0.3	0.02
Soap hardness ($CaCO_3$)	Total			11	0.22

Free CO_2 is also reduced by adding acid and subsequent venting to atmosphere through the deaerating heater's vent condensers.

Deaerator Operation. Some decomposition of bicarbonate to carbonate caused by removal of free CO_2 occurs at deaerator heating temperature. Check tests of pH are taken by a color comparator once a shift, or every eight hours, to double check operation of the conductivity indicating, recording and control equipment. This instrument is also periodically checked for accuracy against a pH meter.

Steam at 15 psig. supplied to the deaerator heaters, raises the temperature of mixed treated water and condensate to saturation temperature 250 F. Periodic tests for dissolved oxygen made by the Winkler method on samples collected at the deaerated water-storage tank discharge, before the addition of Santosite, have always been nil.

Exceptionally good results of deaerator operation are attributed in part to the effectiveness of continuous live-steam flow through an orificed line to the softener. This causes the necessary sweeping effect in the deaerator to produce the oxygen-free water.

One of the 1,000,000-lb-per-hr 6-stage boiler-feed pumps was inspected internally after five years' service. No corrosion or scale was found on any of the surfaces. A typical analysis of the deaerated water before feeding sodium sulphite and including the effect of condensate dilution is given on the right in Table I.

Boiler-Water Analyses. Majority of analyses run on the boiler water are for control purposes. Continuous maintenance of specific conditions in the boiler water is necessary to (1) prevent scale formation most economically (2) inhibit corrosion and (3) maintain satisfactory-quality steam. Cooled boiler-water samples are collected every four hours, or twice a shift, from the continuous blowdown lines and the analyses are recorded on the feedwater dept's daily report.

Alkalinity tests, "A" reading (total alkalinity) and "B" reading (hydroxide alkalinity), are determined by titrating to the phenolphthalein endpoint with thirtieth normal hydrochloric acid. Barium chloride is used in "B" reading to precipitate the buffer salts before titration. "A" reading in conjunction with "B" is taken to determine total alkalinity. "B" reading is necessary for control purposes and must be maintained between 15 and 18 ml of N/30 HCl (200 to 240 ppm NaOH).

Phosphate reserve (PO_4) is determined by a colorimetric method, which is a measure of the color intensity of the molybdenum-blue complex developed on reduction of yellow phosphomolybdate with amino-naphthol-sulphonic acid. This reserve is maintained within the range of 30 to 50 ppm PO_4 with Hagan phosphate, fed directly to the boiler drums by reciprocating pumps.

Feed by pumps is controlled through program timers, set according to test results, to operate a predetermined number of minutes of the hourly cycle. Pumps and the discharge lines are flushed with cooled, deaerated condensate for remainder of the hour. Each week the Hagan phosphate gage method is run as a check test. In addition, it accustoms the operators to this procedure.

Silica determination is also obtained by a colorimetric method. It is a measure of molybdenum blue color developed on reduction with sodium sulphite of yellow silico-molybdate complex.

In control of boiler-water conditions at this plant, it is necessary to maintain (1) "B" reading between 15 and 18 ml of N/30 HCl (2) phosphate PO_4 reserve at about 30 ppm and (3) silica content at about 40 ppm. This relationship is required to precipitate remaining calcium salts in the feedwater as Whitlockite $[Ca_3(PO_4)_2Ca(OH)_2]$ and magnesium silicate as serpentine ($3Mg\ 0.2SiO_2.2H_2O$), to produce a well-dispersed sludge.

Cleaning Boilers. Boilers are cleaned after 8 to 10 months' service. Internal surfaces are cleaned by water-pressure hose washing. Occasionally boiler tubes are turbined and samples of any deposit analyzed. No trouble has been experienced with excess or adherent

sludge conditions. When boilers are drained, sludge in the tubes washes down freely leaving little to dry and set.

Sodium sulphite excess is determined by the iodide-iodate method. This is a quantitative measure of the amount of iodate solution used up in liberating iodine for the oxidation of sulphite to sulphate. Amount of iodate solution is thus a direct measure of amount of sulphate originally present. Sulphite concentration is maintained at about 20 ppm Na_2SO_3. Sulphite feeding is controlled by adjusting piston stroke of the small reciprocating pump delivering the solution at the deaerator discharge.

Sodium sulphate is determined by the Hagan sulphate gage method. In this test, sulphate is precipitated as barium sulphate and amount is estimated from volume of solution producing a standard turbidity. It is not our practice to hold strictly to the sulphate-alkalinity ratio for caustic embrittlement preventions. The sulphates are, therefore, allowed to vary and are used as a check, correlating with the continuous blowdown rate and total solids concentrations.

Titrating with silver nitrate determines chloride (Cl). In this test, chloride is precipitated in a substantially neutral solution as silver chloride through titration with silver nitrate. Red silver chromate appearance signals the endpoint. Chloride test serves partly as a control and as a check test on blowdown rate.

As an aid to control of continuous blowdown a conductivity instrument is used. This rate is regulated to maintain a conductance of boiler-water dissolved solids within a normal operating range of 1800 and 2200 micromhos. Correlation of conductivity readings with dissolved solids and total solids by evaporation is carried out to produce a factor to determine these solids by conductivity tests. This gives a quick, comparatively accurate way to determine solids concentration.

At present, total solids are maintained below the 2500-ppm maximum, set by boiler manufacturers. Boilers have cyclone separator and scrubber elements within the steam drums to reduce carryover. Recently, a boiler-feed pump turbine and a main turbine (both use 410-psig steam direct from main header) were inspected internally and found free from deposits. This indicates that severe carryover does not occur even though very high total solids exist at various times for short periods. Table II gives a typical boiler-water analysis.

Conductivity Recorder. A recording conductivity instrument is being installed. It will determine through a degasifier the steam purity from any boiler at any load, and will also record return-condensate purity from turbine-generators and process units when desired. With this information we can find the safe limit to which boiler-water concentrations may be increased to realize an economic gain.

TABLE II—TYPICAL BOILER-WATER ANALYSIS

	ml
"A" reacing Ml N/3 (HCl)	21.0
"B" reacing Ml N/30 (HCl)	17.2
	ppm
Iodine demand as Na_2SO_3	20
Sulphate (SO_4)	625
Chloride (Cl)	135
Nitrate (NO_3)	10
Phosphate (PO_4)	40
Total solids	2235
Organic (other soluble)	5-10

With this system of semi-automatic control, boiler operators must inform feedwater operators when boiler loads are to be or have been changed. Continuous blowdown valve and phosphate-feed adjustments to maintain proper, uniform boilerwater conditions are then made.

Chemical Tanks. The feedwater operator and his helper charge the chemical tanks during the day shift. These tanks have ample capacity for 24-hr operation. At ordinary loads the lime and soda-ash charge averages about 900 and 400 lb, respectively. These tanks must be charged quickly to prevent as far as possible softener-control fluctuations and to allow the chemical to mix thoroughly before next feeding period. Charging is completed within three minutes, which meets the system's needs.

The day shift also backwashes the filters, which requires on the average about 15 min per filter. Backwashing can be done with either treated water direct from the softener discharge header, or filtered water from the filter-battery discharge header. Rotary agitators in the filters help break up the sludge bed, which is pumped back to the softeners and precipitated and discharged to the sewer through a sludge blowoff valve. Automatic control of this valve is by a solenoid-actuated pilot valve, energized through a manually set program timer on the feedwater panelboard.

The timer gets its impulses from the raw-water flowmeter-integrator contacts for a given water flow. De-sludging time is checked at various load changes by an Imhoff cone test. The Imhoff-Pyrex cone holds one liter of slurry and is graduated from the apex in milliliters. Immediately after a blowdown cycle, a liter or 100-cc sample of sludge is drawn from close to the sludge blowoff valve on the softener cone. The sludge is allowed to settle in the Imhoff cone for a maximum of 15 min and percentage of sludge settled out is observed. When sludge concentration drops to about 0.6%, blowdown is stopped to reduce water loss to the sewer and to have sufficient sludge in the softener cone to assist agglomeration of the precipitate.

Check tests, reagent mixing and analyses incidental to operation and control are done in the feedwater supervisor's laboratory office. The feedwater daily reports supply data to record chemicals used and average analyses in graphical form, which shows variations in relation to average boiler-loads and other factors. On p 109 is a graph for three-months' operation of the softener. Boiler conditions during the same period are given on another graph. These graphs serve as a permanent record, and may be used to produce blueprint copies if desired.

The major maintenance work entails the annual internal surface cleaning of softeners, deaerators and filters. Softener scale is removed by hammering, chipping or scraping and water-pressure washing. A thin deposit that builds up on the deaerator trays is easily removed by wire brushing. The filters are cleaned by water hose washing of the beds. During five years' operation, however, they have accumulated a few inches of sludge deposit around the shell and under the anthracite-coal bed. It is planned to remove this objectionable condition by circulating inhibited hydrochloric acid through the filters.

During 1948, a total of 4,922,000,000 lb of water were softened with 223.7 tons of lime, 118.8 tons of soda ash and 31.9 tons of sodium silicate. The pH adjustment of the treated water required 47 tons of sulphuric acid. As an adjunct to eliminate dissolved oxygen entering the steam drum, 3.5 tons of Santosite were used; 36.7 tons of Hagan phosphate were consumed to treat boiler water internally. On the basis of gross steam produced for the year (7,353,000,000 lb) cost of chemicals was 0.279c per 100 lb of steam.

Operating characteristics at our plant do not necessarily apply to other water-treating systems, and this information should not be misconstrued as hard and fast rules to follow. It is our desire in furnishing these operating data that others may gain information of value in some measure. Retaining a consulting firm for boiler-feedwater conditioning has proved helpful at this plant to (1) set up the proper analyses and control procedures (2) assist in correcting various problems that arise from time to time, and (3) keep the plant informed on up-to-date and new developments pertaining to water treating for trouble-free operation.

ELECTRONICS FOR THE POWER ENGINEER

By F A ANNETT, *Associate Editor*

16—Electronic Alternating-Current Relays

► WE STUDIED the application of electronic amplifiers with relays on dc in the previous article. Here we will consider similar equipment for ac circuits. To use ac requires only slight changes in the circuit arrangements. In these circuits the triode acts both as an amplifier and rectifier; also, a transformer provides the required voltages for the different circuits.

Amplifier and Relay. Fig. 1 shows the connections for a simple amplifier connected to a relay. The transformer's secondary has three sections: One supplies power to the relay coil, a second low-voltage section heats the cathode, while a third section puts bias on the grid to control the tube's output. *D* may be assumed to be the contact of a contact-making voltmeter or similar device that can handle only a very small current.

For the transformer polarity shown and contact *D* closed, the grid has zero bias because it and the cathode connect at *E*, so no potential exists between them. Closing contact *D* connects the grid section of the transformer across R_1, and current flows from S_3 through R_1, contact *D*, to S_3, as indicated. This current is small because R_1 has a high resistance.

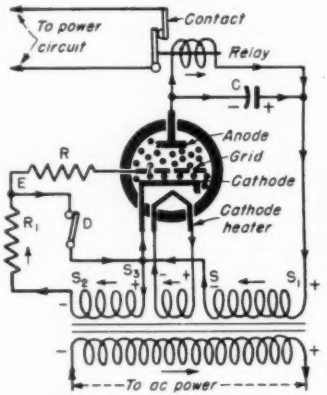
Since there is no bias on the grid the tube conducts. Current flow is from *S* through the tube and the relay coil back to S_3. Capacitor *C* is also charged to the polarity shown. The relay closes its contacts to energize directly or through an auxiliary, the power-contact coil on a motor starter, or for some other operation.

When transformer polarity reverses, Fig. 2, the tube does not conduct because current cannot flow from anode to cathode, as has been emphasized many times. When current in the relay coil starts to decay, inductance of this coil tends to keep it flowing. Also, as the voltage across the coil decreases, capacitor *C* discharges through it. Note that the capacitor's polarity is correct to discharge through the relay coil in series with its induced voltage. This maintains a decreasing current through the coil to hold the relay closed and prevent it chattering.

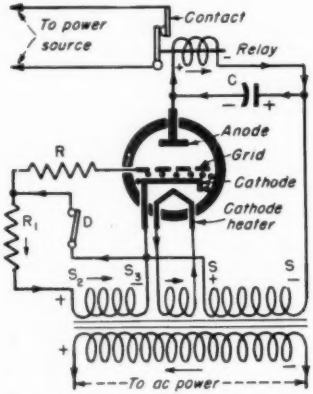
Assume contact *D* open as in Fig. 3. The circuit is broken through this contact to apply full voltage of transformer section S_2S_3, from grid to cathode, to put minus bias on the former and block the tube. When transformer polarity reverses, the tube cannot conduct, as in Fig. 2. But with contacts *D* open, the grid has + polarity and acts as an anode to the cathode. Current then flows from S_3 on the transformer to the cathode and grid, *R* and R_1, back to S_3. This is known as grid rectification.

Grid Resistance. To limit this current to a very low value and protect the grid, resistors *R* and R_1 are chosen with a combined resistance of several

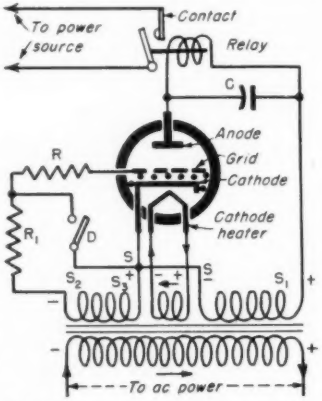
Relays Operated by Contact Switch



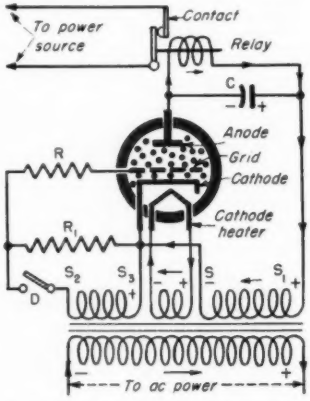
When contact *D* closes it removes bias from the grid, and tube conducts



2 Connections are same as Fig. 1, but the transformer polarity is reversed



3 When contact *D* opens, the grid is biased to block tube and open relay



4 Contact *D* is so connected that, when open, tube conducts to close relay

megohms. Resistor R is not generally required on dc because cathode and grid polarity does not reverse.

In Fig. 1 to 3 the tube conducts when contact D is closed. For some applications the tube is required to conduct when D is open. Fig. 4 shows how this is done. When D is open, transformer section S_2S_3 is disconnected from the grid, so its potential is at zero and the tube conducts as indicated. What has been said about Fig. 1 applies equally to Fig. 4, except the grid.

Closing D completes a circuit through R_1 in which current flows. A potential is applied on the grid from S_2 through resistor R, to the grid, the cathode, back to S_2. This puts a minus bias on the grid to block the tube. On reverse polarity with D closed the grid becomes an anode for current flow from S_2 to the cathode and grid, back to S_2. As explained for Fig. 3, resistance R is made high to keep this current very small to protect the grid.

Phototube Control. In Fig. 5 a phototube substitutes for contacts D, Fig. 1 to 3. The relay connections are the same in the diagrams so we need only consider the phototube's action. Assume that no light reaches phototube P so that it cannot conduct but acts as an open switch, Fig. 3. Then full voltage of secondary section S_2S_3 appears as a minus bias on the grid of amplifying tube E, to block it. The relay remains open.

On the next half cycle, Fig. 5, the polarity of the transformer reverses. Current will now flow from S_2 to the cathode and grid, through resistors R and R_1 to S_2. This current flows whether light shines on the phototube or not. When S_2 is minus, as in Fig. 2, current tends to flow from S_2 through phototube P, resistor R_1 to S_2. The tube cannot, however, conduct from anode to cathode, and in this direction acts as an open contact.

A light beam shines on the phototube, Fig. 6, and it conducts on the transformer polarity shown. This circuit is from S_2 through R_1, the phototube to S_2. By selecting R_1 with a very high resistance, practically full transformer potential appears across this resistor with a small voltage across the phototube. Only the voltage across tube P appears as a grid bias, which is so low that tube E conducts and closes the relay, as indicated.

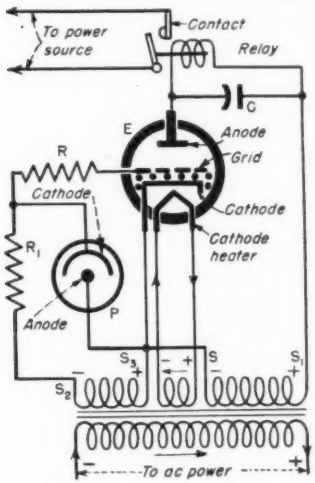
Here we see one difference between the phototube and contact D to control amplifying tube E. When contact D is closed, grid bias is reduced to practically zero, whereas in Fig. 5 the bias cannot be less than the volts drop across the phototube.

Dark Phototube Control. In Fig. 5, amplifying tube E conducts when light shines on the phototube's cathode, which is the condition required for certain applications. Others require the amplifier to conduct when the phototube is dark and not to conduct when light shines on its cathode, as in Fig. 7 and 8. Here the phototube conducts on the opposite polarity from amplifying tube E.

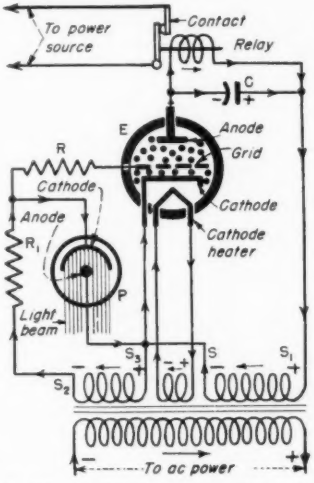
With transformer polarity shown and the light beam on the phototube, the latter conducts. This circuit is from S_2 through tube P, resistor R_1 to S_2. Capacitor C_1 is charged to the polarity shown. Current also tends to flow through resistor R to the grid and cathode, back to S_2. No current flows, the grid and cathode being separated, but a potential exists between them equal to the voltage drop across R_1.

By selecting R_1 with a high resistance, nearly total voltage across S_2 and S_3 will exist across this resistor.

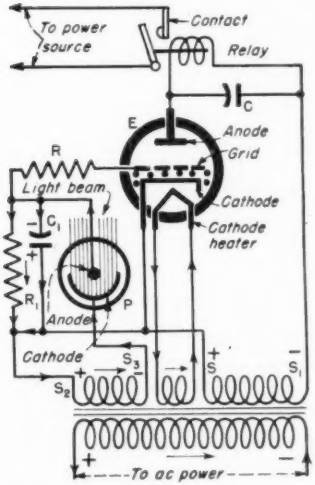
Phototube Actuates the Relays



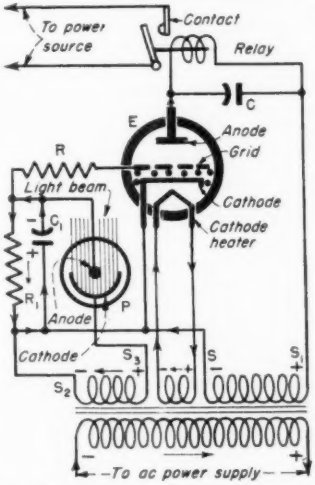
Phototube P replaces contact D, Fig. 1 to 3, to open and close the relay



6 When light shines on cathode of phototube P, tube E closes the relay

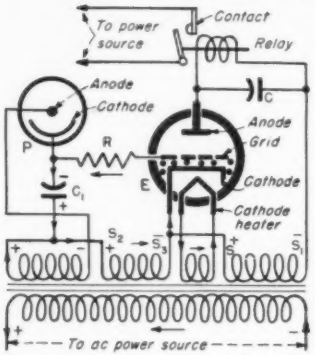


7 Phototube P conducts on the opposite transformer polarity from tube E

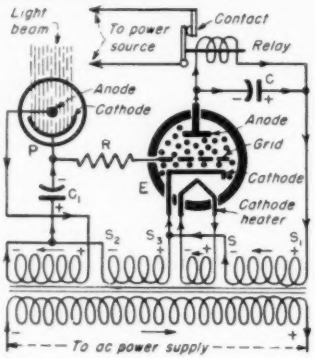


8 When the transformer's polarity reverses, the phototube cannot conduct

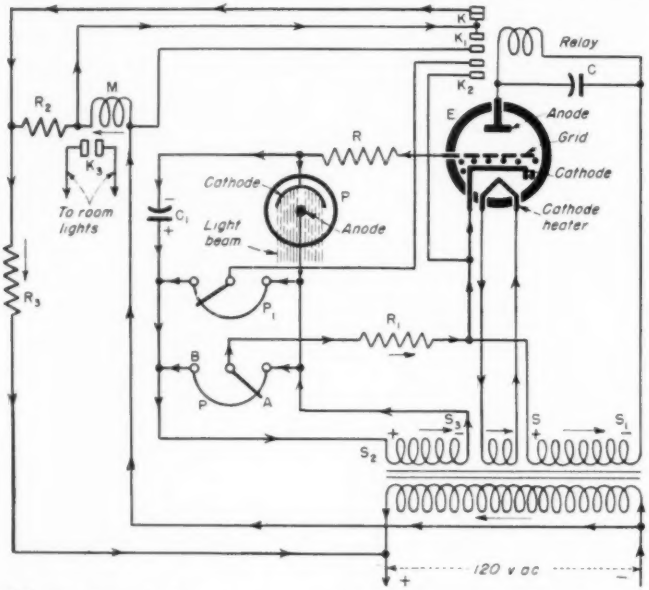
Some Other Phototube Controls



9 When phototube *P* is dark, tube *E* is blocked and so it cannot conduct



10 When light shines on phototube *P* tube *E* conducts to close the relay



11 The phototube *P* turns on the room lights when natural illumination falls below a given level and turns off the lights when natural illumination is high

This is the potential applied to the grid as a minus bias to block tube *E*. Capacitor C_1 is also charged to this potential. When the transformer's polarity reverses to that in Fig. 8, the phototube cannot conduct because its anode is minus.

Capacitor C_1 discharges through resistor R_1, as indicated, to maintain minus bias on the grid. This bias exists because if the grid touched the cathode the capacitor could also discharge through resistor *R*, the grid and cathode to + on the capacitor. Since the grid and cathode do not touch, the capacitors voltage exists as a minus bias on the grid to block amplifying tube *E*. If in Fig. 7 the phototube were dark it would not conduct. In fact it would act as if replaced by an open switch. This is the equivalent of disconnecting transformer terminal S_3 from the grid circuit, leaving the grid with zero bias so tube *E* conducts.

Light Beam Changes. Light may be cut off from the phototube completely and quickly, as by a box or other object on a conveyor passing through the light beam to operate a counter or perform other operations. Light on the phototube can also be changed gradually as when the light beam crosses a boiler breeching or stack onto the tube's cathode. In another such application the light beam crosses a ventilating-system duct near the fans. In the former, the phototube through the amplifier can operate a smoke-density indicator or recorder and actuate an alarm system.

To protect a ventilating system from being filled with smoke the relay can have two contacts, one closed when the other is open. The one that is closed when the relay is deenergized is connected in series with the overload contacts on the fan-motor starter. The other contact conects in the circuit of a ventilating-duct damper closer.

Should smoke enter the ventilating duct, as it crosses the phototube light beam, the light reaching this tube is reduced to cause the amplifier to conduct and close the relay. The relay opens its contact in series with the overload contacts to stop the fan motor. The other closes to actuate the damper to cut off the ventilating system from the source of smoke.

Other Phototube Uses. Fig. 9 shows another way that a capacitor and a phototube may be used to control the amplifier output. When the tube is dark as in Fig. 9 and the transformer has the polarity shown, the amplifier cannot conduct because its anode is minus. The grid connects through resistor *R* and capacitor C_1 to S_3. Terminal S_3 of the transformer is minus and connects to the cathode. Under these conditions the grid acts as an anode for the cathode and tube *E* conducts to charge capacitor C_1 to the polarity shown by grid rectification.

When transformer polarity reverses, capacitor C_1 tries to discharge from its – side, through the grid and cathode, S_3 to S_2, and the + terminal of the capacitor. It cannot do this but biases the grid to block the amplifier.

When light falls on the phototube, Fig. 10, and the transformer has the polarity shown, the phototube conducts to discharge capacitor C_1, as indicated by arrows. This reduces the bias on the grid, and tube *E* conducts to close the relay.

Room-Lighting Control. Fig. 11 is a diagram of a room-lighting relay in which grid rectification is employed. When the amount of daylight coming in through the windows is below a given intensity a phototube turns on the lights. It also turns off the lights when daylight in the room is above a required illumination level.

(*Continued on page 118*)

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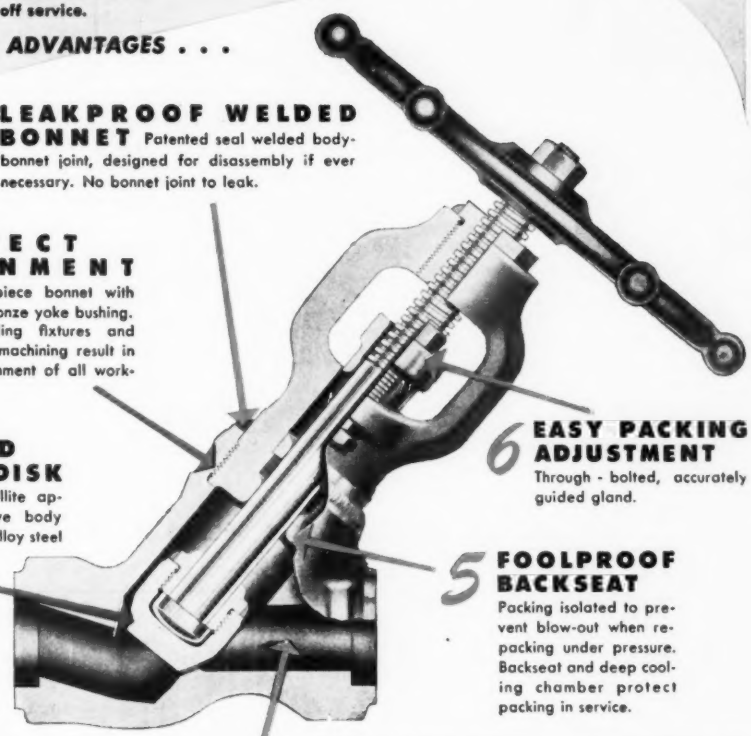

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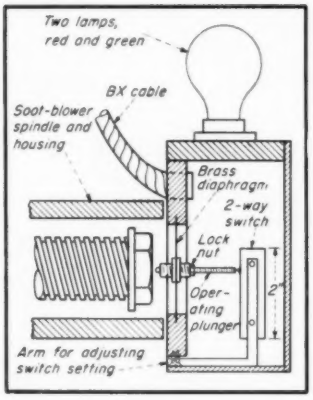
POWER ENGINEERS' NOTEBOOK

PLANT-TESTED IDEAS TO SOLVE PROBLEMS OF DESIGN, OPERATION AND MAINTENANCE

AUTOMATIC SIGNAL LAMPS GUIDE SOOT-BLOWER OPERATION

IN A NEW BOILER INSTALLATION we experienced trouble with the hand-operated retractable soot blowers. After a short period of initial operation the nozzle ends were burned causing steam leaks. These jets impinged on one of the boiler baffles practically destroying it.

To find out whether this was caused by the native operators leaving the soot blower in the *in* position or by wrong positioning of the soot blower, we built the signal box shown in the sketch. The blower nozzle travels by rotation of a threaded spindle in a stationary nut. A cylindrical cover houses the spindle and acts as the container for the lubricating grease. We removed the end plate of this housing and substituted a 6x3-in. plate into which a 1/32-in-thick brass diaphragm was recessed.



Center of the diaphragm is punched to take a bushing threaded inside and outside. The bushing bolts to the center of the diaphragm. A bolt and locknut to fit the inside of the threaded bushing completes the diaphragm assembly. The bolt is adjusted so, when the soot-blower is in the *off* position, the diaphragm depresses about 0.004 in. This movement operates a 2-way micro switch connected to change over lights from red to green. Red light burning indicates soot blower in the operating position, green in the *off* or retarded position.

The supervisor can now see the soot-blower position from a distance. Moreover, the operators quickly learned to leave the blower with only the green light burning. No further trouble has since been experienced with damaged nozzles or baffles. The lights and switch have proved to be an inexpensive solution and reliable addition to operation. Only two 1/4-in. setscrews have to be taken out to remove the switch assembly completely in case the soot blower needs maintenance attention. This equipment has proved to be a worthwhile investment.

T SHAW *Kitive, North Rhodesia*

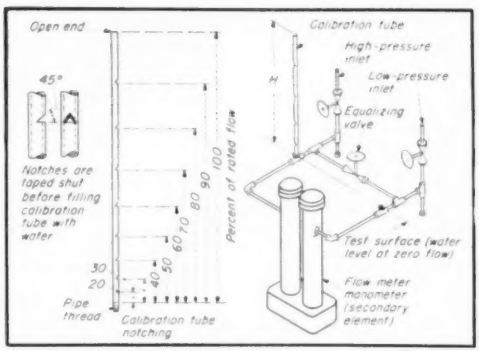
NOTCHED CALIBRATION TUBE SPEEDS FLOWMETER CHECKING

THE USUAL METHOD of flowmeter calibration uses a glass tube. Considerable time is generally needed to adjust the height of water column, and at times it may be awkward to make precise measurements.

The tube in the sketch has been used to make checks quickly and accurately. It may be of ½- or ⅜-in. pipe, threaded at one end and notched. Each notch represents a height of water column corresponding to a selected chart or indicator division. The sketch shows how it appears for 10% intervals between 20 and 100%. Tees must be installed in the high- and low-pressure connections of the meter manometer with the branches turned up, as shown, and the openings in the same horizontal plane. These are on the surface from which the measurements of the columns have been taken.

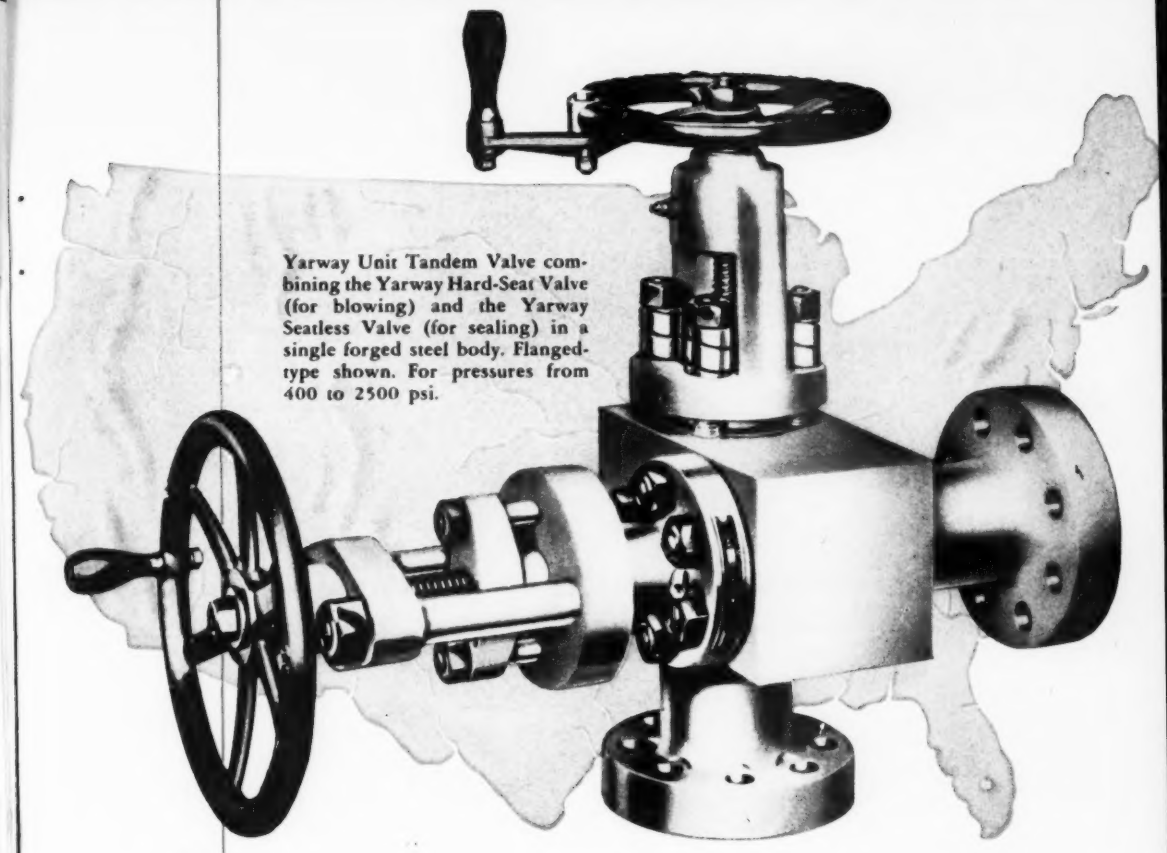
The tube must thread tightly into the h-p tee to a predetermined mark. Notches are taped up to be water tight and the tube completely filled with water. The recording chart should register 100% rated flow. The tape at the 90% notch is then removed allowing the water to spill out and settle at this level. For this head the meter should read 90% of rated flow. The tapes are then successively removed down to the last, and the meter readings noted.

Locate the notches on the tube as follows: After preliminary tightening in the h-p tee, mark the tube flush with the test surface. This is the base of all measurements. From the meter data sheet find the height of water column for full rated flow. Lay this distance off on the tube and cut off the end squarely at this point. To find the intermediate points study the following example. For 80% flow on a 100% rated flow corresponding to 50-in. water head apply the flow rate as a decimal. Then $0.8 \times 0.8 \times 50 = 32$ in. Head for 80% flow is 32 in. high.



MILTON N KRAUS *Sunnyside, L. I., New York*

(*Continued on page* 118)



Yarway Unit Tandem Valve combining the Yarway Hard-Seat Valve (for blowing) and the Yarway Seatless Valve (for sealing) in a single forged steel body. Flanged-type shown. For pressures from 400 to 2500 psi.

NORTH

WEST EAST

SOUTH

it's YARWAY 4 to 1

From every corner of the country comes the same story—four out of every five high pressure boiler plants are equipped with Yarway Unit Tandem Blow-Off Valves.

Each day's orders add to the evidence. From Ohio . . . 17 new Yarways, making a total of 746 purchased by this large utility over the last 35 years. From California . . . 10 new Yarway Unit Tandems for one company, 9 for another. Texas sends an order of 5 . . . 3 for one new municipal plant, 2 for another. Northern New York wants 7 for new boilers in a well-known utility. And so it goes.

Why this overwhelming preference?

Proved dependable performance, due to outstanding design, sound engineering and careful manufacture . . . plus constant research, leading to mechanical and metallurgical advancements that keep Yarway Valves ahead of changing service requirements.

For latest information on Yarway Unit Tandem Blow-Off Valves, write for Yarway Bulletin B-432.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.

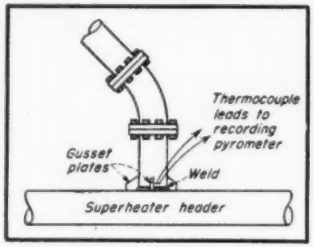
YARWAY BLOW-OFF VALVES

POWER ENGINEER'S NOTEBOOK (*Continued from page 116*)

STEPS TAKEN IN REPLACING DEFECTIVE SUPERHEATER NOZZLE

A SUPERHEATER NOZZLE on a high-pressure boiler failed by developing a crack during operation. After taking the boiler off the line, the defective nozzle was burned off near the weld. The old weld was ground off flush with the superheater header and the opening beveled to conform with the mating edge of the replacement nozzle.

Prior to tack welding the nozzle to the header it was bolted on the 45-deg elbow, see sketch. A chill ring was provided for the welding operation. Each welded bead was chipped off before laying the next one. After the joint was completely welded four gusset plates were welded in place as shown in the sketch above.



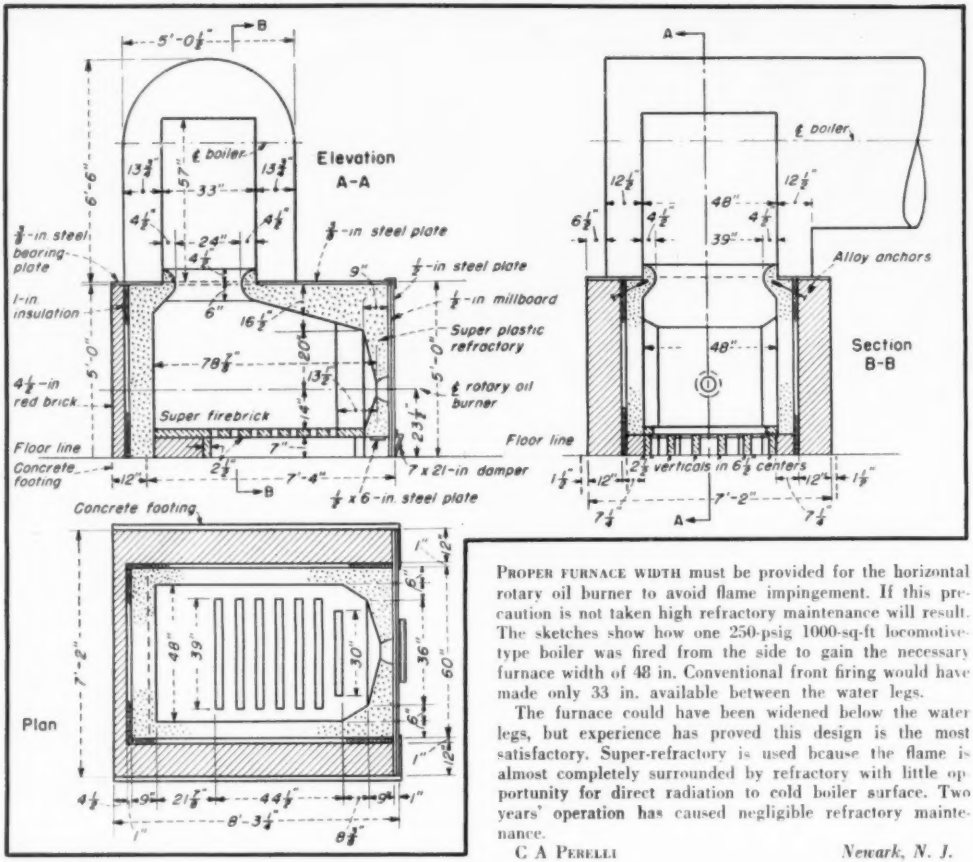
To check on the workmanship, the weld was X-rayed. Four film sheets were placed along the length of the weld and covered with lead plates. The radiation capsule was then placed at the center of the joint for the duration of the exposure. The films showed the weld to be in perfect condition.

To stress relieve the joint, two large-tip acetylene torches were used for heat supply. Thermocouple leads were welded to the nozzle about 2 in. from the weld. These connected to a recording pyrometer. Temperature was raised over a three-and-one-half-hour period to 1150 F and held there for a total time of one hour.

After cooling off, the boiler and superheater were given a hydrostatic test as a final check.

M N GOZDENOVICH *Fairview, N. J.*

HOW TO ADAPT ROTARY OIL BURNERS TO LOCOMOTIVE-TYPE BOILERS



PROPER FURNACE WIDTH must be provided for the horizontal rotary oil burner to avoid flame impingement. If this precaution is not taken high refractory maintenance will result. The sketches show how one 250-psig 1000-sq-ft locomotive-type boiler was fired from the side to gain the necessary furnace width of 48 in. Conventional front firing would have made only 33 in. available between the water legs.

The furnace could have been widened below the water legs, but experience has proved this design is the most satisfactory. Super-refractory is used because the flame is almost completely surrounded by refractory with little opportunity for direct radiation to cold boiler surface. Two years' operation has caused negligible refractory maintenance.

C A PERELLI *Newark, N. J.*

SUNVIS GOING STRONG AFTER 3,500 HOURS

Body-Stamping Presses Still in A-1 Condition; Make-Up Oil Amounts to Only 1% per Month

One of the best-known automobile manufacturers selected Sunvis to lubricate three brand-new body-stamping presses. This equipment involved a big investment, and the company wanted the finest protection available.

After 15 months' use, the oil was tested and found to be in virtually the same condition as at the start. The machines were carefully examined and proved to be as good as new. The original charge of Sunvis is still in service and make-up oil has amounted to only one percent per month.

Because of performance like this, "Job Proved" Sunvis Oils are in wide demand wherever the finest lubrication is needed. They have high stability over a wide range of speeds, loads, and temperatures. You can count on Sunvis Oils for top performance and the surest protection of your machines. For full information call your nearest Sun Office.

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PROBLEMS FROM THE PLANT

Exercise your engineering wits by submitting answers to this question, fresh from the plant. Suitable material will be paid for; answers accompanied by sketches or photographs command additional pay

What Are the Advantages of a Grounded System?

HERE'S A PROBLEM we have been been tossing back and forth during the past few weeks. Many of the boys here in the plant disagree with me regarding grounded vs ungrounded electrical systems in industrial plants.

In our particular plant we have two wye-connected 2000-kw 11.5-kv generators. At the time of installation we considered it best to leave the generator neutrals ungrounded. Our thinking was that in the event of an accidental ground the static ground detector on the main switchboard would light; then we would go to work and find the point of trouble.

On the other hand, many boys in our plant believe a grounded neutral on the generator offers the safest and most dependable system. We would appreciate hearing from POWER readers to get their slant. We probably wouldn't do anything about it here but it would keep our thinking straight on the general subject of grounding.—*DR*

READERS' ANSWERS

What Damage Stems From Unbalanced Loading?

(This question is from May issue with best answers from readers.)

ON A RECENT TRIP *through our plant I noticed a seriously-unbalanced-load condition on one of our turbine-generators. The unit is rated at 1500 kw, 1875 kva, 3600 rpm, 2400 v and 60 cycles.*

Load unbalance showed up on the switchboard ammeters; two phases had a load of about 500 amp, while the third carried 300. Machine nameplate showed the unit was rated for 451 amp per terminal.

Our chief electrician, who was on hand at the time, mentioned that the unbalanced-load condition was perfectly OK and assured us no damage could result. The operating engineer took quite another stand. He felt anything in excess of a 10% unbalance might damage the generator. Moreover, he regarded the unbalanced condition as most critical, and recommended installation of differential relays to trip off the machine if the unbalance should rise to 10 or 15%.

Incidentally, these periods of unbalance are not momentary, but are maintained for hours and many times for days on end. In view of this I feel the operating engineer was taking the proper stand. No doubt many POWER *readers have definite ideas on this subject so I would certainly appreciate getting their slant. What is likely to happen if this unbalance is allowed to continue? How long will the machine stand such periods of unbalance?*—AE

Take Generator Off Line

AE HAS A SERIOUSLY-UNBALANCED generator load condition. In the first place, amp per terminal ratings are exceeded on two phases. That is poor practice even with perfect phase balance. Additional localized rotor overheating from phase unbalance places generator in the critical classification.

Unbalanced stator currents cause eddy currents to flow in rotor wedges and on surface of rotor. Value of these currents is a function of the unbalance and magnitude of phase currents. Frequency of eddy currents is double generator frequency or, in this case, 120 cycles. When eddy currents are large as in this generator, severe localized heating occurs at wedge joints. This heats up the entire rotor face. To prevent overheating of the field winding, phase unbalance must be minimized as generator load increases.

From this it is apparent that no single unbalance limit can be set for the entire range of generator loads. If *AE* will write the manufacturer, he will supply him with a curve or formula from which he can calculate maximum permissible phase unbalance at any given load.

Application of differential relays to protect generators against phase unbalance is not practical because of the variation of permissible phase unbalance with load change. Differential relays are usually applied to protect generators from internal interphase leakage or ground currents.

Winding temperatures are probably high; hence life of insulation is being shortened and continued operation under these conditions will eventually result in failure. Such failure is likely to occur during a period of mechanical or electrical stress due to a line surge or poor synchronization. *AE* should immediately remove generator from service and examine wedges and tooth surfaces for evidence of heating. Future phase unbalance should be limited strictly within the limits established by the manufacturer.

W VAN TASSEL *Willmar, Minn.*

Two Phases Overloaded

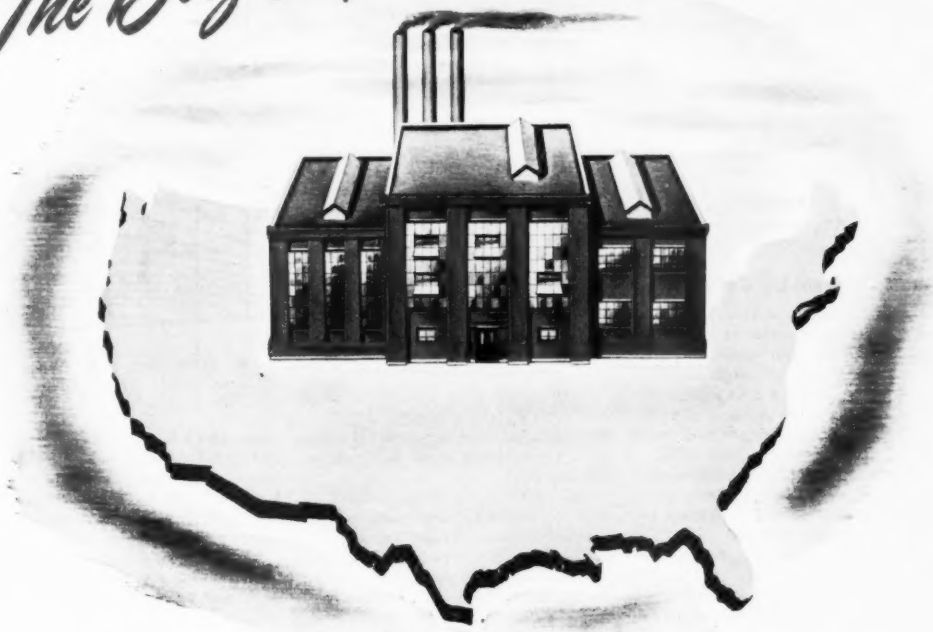
PHASE UNBALANCE in an electric generator is a problem that's always present in machines supplying mixed loads. Unbalanced loading has the over-all effect of reducing the generator output. Maximum wattage load for any phase multiplied by number of phases is the machine's maximum output. If one or two phases operate at less than maximum, that means capacity lost. But this is of importance only when heavily loaded.

A 500-amp load on a machine designed for 451 amp per terminal is a heavy unbalance especially if machine operates 24 hr per day. But the real test is whether the machine heats up beyond its rated temperature rise. If so, steps should be taken to balance the load. Continued operation at high temperatures will decrease life of windings.

If load is from an industrial plant, unbalance can be located by taking ammeter readings at various points in the distribution system until the point of unbalance is definitely located. I suggest *AE* check the lighting and other single-phase loads. Also check the system for grounds.

IRA A BUTCHER *Piney River, Va.*

The Betz Organization



. . . and your plant

BETZ is a nation-wide organization of engineers and chemists specializing in the solution of problems involving boiler feed water . . . cooling water . . . process water . . . waste recovery . . . stream pollution.

Your particular water problem, which may involve scale, corrosion, foaming, algae, embrittlement or product contamination, can be solved by Betz. For, in the Betz Organization, you will find the facilities and services necessary for the efficient solution of all industrial water problems. Years of experience have made Betz water conditioning service scientifically correct . . . complete . . . economical.

Wherever your plant may be located, our nation-wide staff of engineers is ready to serve you. May we have a Betz engineer call to discuss your specific problems? There's no obligation, of course. W. H. & L. D. BETZ, Gillingham and Worth Streets, Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

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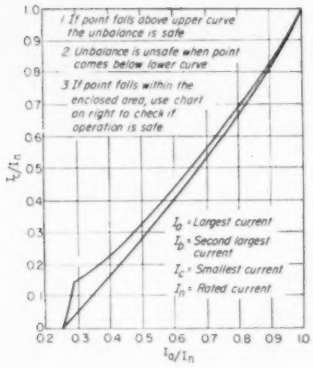
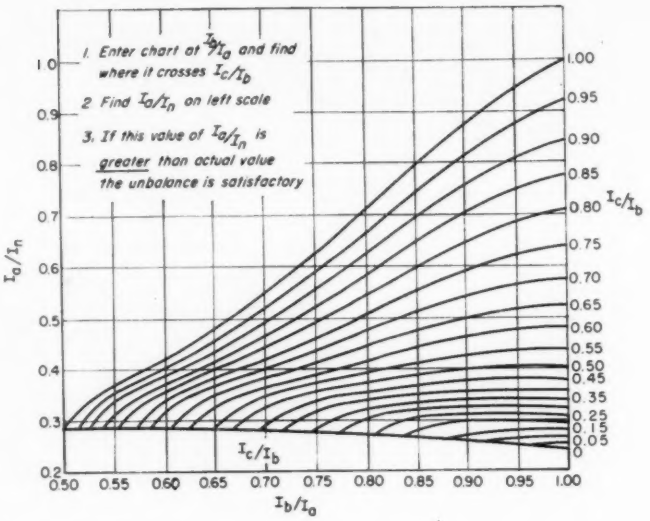
BOILER WATER CONDITIONING • COOLING WATER CONDITIONING • INDUSTRIAL WASTE TREATMENT


1. If point falls above upper curve the unbalance is safe
2. Unbalance is unsafe when point comes below lower curve
3. If point falls within the enclosed area, use chart on right to check if operation is safe
I_a = Largest current
I_b = Second largest current
I_c = Smallest current
I_n = Rated current
I_c/I_n
I_a/I_n


1. Enter chart at I_b/I_a and find where it crosses I_c/I_b
2. Find I_a/I_n on left scale
3. If this value of I_a/I_n is greater than actual value the unbalance is satisfactory
I_a/I_n
I_c/I_b
I_b/I_a

Limits Shown by Curves

AE's UNBALANCED OPERATION is not considered safe by generator manufacturers who shy away from mentioning any definite percentage of unbalance without knowing actual details of the unit under consideration. About 10% is the usual maximum unbalance and some manufacturers drop this figure to 5%.

Most serious result of unbalancing is heating of rotor iron. In one case I found the rotor ruined completely because of unbalanced loads.

With a properly designed copper winding inserted in the rotor iron, similar to a squirrel-cage induction-motor rotor, it may be possible to operate at close to 100% single-phase load. But this type of construction is costly and may not be practical to install on existing units.

One of the large manufacturers of electrical machinery has issued instructions concerning allowable unbalance of armature currents in turbine generators. These are based on above curves using as coordinates the ratio of largest current to rated current and smallest current to rated current. In *AE's* case the ratios would be, *A*, 500 ÷ 451 or 1.11, and *B*, 300 ÷ 451 or 0.66. These curves have a range from 0.25 to 1.0 for *A* and 0 to 1.0 for *B*. It may be readily seen that according to this manufacturer's criterion the unbalance is unsafe.

It is assumed, of course, that the face of the revolving field rotor has no imbedded copper elements making it suitable for unbalanced loading.

C O VON DANNENBERG *B'klyn, N. Y.*

May Be Caused by Ground

AE SHOULD CONSIDER several factors in connection with possible generator damage when operating with an unbalanced load. To start, we can first discuss the possible damage from the unbalanced currents. Excess rotor heating can be traced to negative sequence components of the unbalanced currents. These components in the armature (stator) winding create a magnetic flux in air gap that rotates at synchronous speed in a direction opposite to the normal motion of field structure. Induced currents of double frequency (120 cycles) are, therefore, set up in the field structure and flow in the rotor surface. These surface currents cause considerable heating and are liable to result in field failure because of insulation breakdown. It is even possible that damage might be done to the mechanical structure of rotor.

Aside from the question of unbalanced currents, it is obvious from data given that the two phases carrying 500 amp are overloaded considering the machine rating of 451 amp per phase. Balancing the load would result in a kva load below the machine rating and the currents would also be below the rating of 451 amp per phase. There is the possibility of trouble within the machine, such as a grounded phase returning part of load current through ground. This, of course, is only conjecture but should be thoroughly checked along with all other factors.

Differential relays remove the machine from line in event of internal faults. As a parting shot, it might be well as a first measure to check instruments to determine if observed readings are correct.

W G WEEKS *Arlington, N. J.*

Make Sure Ct's Are OK

AE SHOULD BE more concerned about overloading than phase balance. With the percentage of unbalance given, limit of phase overload should be about 15% for reasonable generator life. Any greater load may cause hot spots.

I would question use of differential relays in *AE's* application.

AE should check his metering to make sure ct's are not shorted, overloaded or otherwise defective. This alone could make his unbalance appear more than it actually is and, of course, the opposite is also true.

G W BENEDICT *Montpelier, Vt.*

Is Ammeter Accurate?

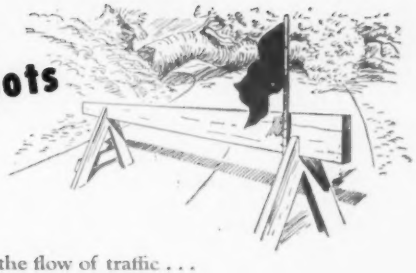
THREE-PHASE LOADS, such as motors and rotary converters, are inherently balanced. Single-phase loads, when separate and unrelated, tend to unbalance the system. A better grouping of lamps and single-phase motors will produce a system that is practically always in balance.

AE should check: (1) separate phase resistances and reactances (2) switchboard ammeter (3) condition of equipment connected to each phase. From these data he will be able to determine

(*Continued on page* 166)

an K "reason why"

stands guard at danger spots

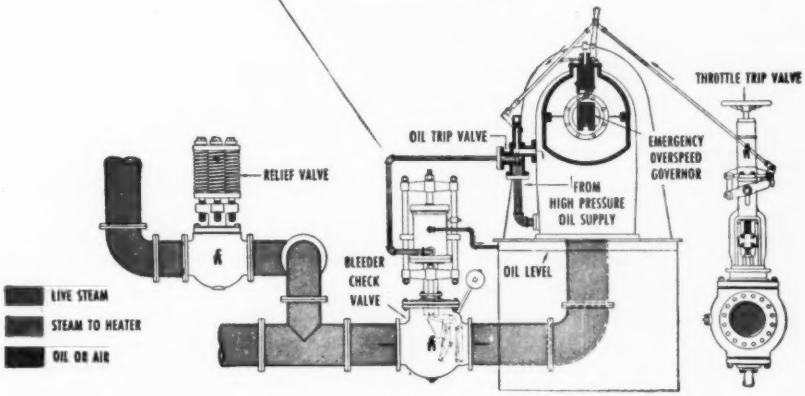


A road-block stops the flow of traffic . . .
Until the danger is past.

An K Turbine Protection System stops flow, too . . .
Stops flow of h. p. steam to turbine . . .
Stops back-flow of l. p. steam . . .
And relieves excess pressure . . .
In extraction line.
It stands guard at danger spots.

Each valve in the system . . .
Throttle, Oil Trip, Bleeder Check, Relief . . .
Performs a particular function . . .
Works with the others . . .
To protect the turbine.

Bulletin 8K contains detailed information . . .
Send for your copy today.



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ENGINEER'S BOOKSHELF

REVIEWED IN THIS ISSUE

ELECTRICITY FOR STUDENTS OF SCIENCE AND ENGINEERING
BASIC ELECTRICAL PRINCIPLES • ELEMENTS OF APPLIED HYDROLOGY
ARCTIC AND HUDSON BAY DRAINAGE • ENGINEERING ECONOMICS, PRACTICE
STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS • WELDING METALLURGY
INFLUENCE OF NONFERROUS METALS AND THEIR COMPOUNDS ON CORROSION
MATHEMATICS FOR ELECTRICIANS • CENTRIFUGAL PUMPS, BLOWERS (German)
STANDARD WELDING TERMS AND THEIR DEFINITIONS • DIESEL ENGINES
ELECTRICAL TRANSMISSION OF POWER, SIGNALS • METALLURGY AND PIPING
SCAVENGING OF 2-STROKE CYCLE DIESELS • INDUSTRIAL ELECTRICITY
ASTM SPECIFICATIONS FOR STEEL-PIPING MATERIALS • POWER CAPACITORS
OXYACETYLENE WELDING AND CUTTING • BASIC ELECTRICAL ENGINEERING
ELEMENTS OF DIESEL ENGINEERING

Electrical Handbook

STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS (*8th edition*). *Archer E Knowlton, editor-in-chief, and R M Shoop, assistant editor, both on the editorial staff of "Electrical World."* 2311 *pp*, 9¼x6¾, *cloth*, $12. *McGraw-Hill Book Co*, 330 *West* 42 *St*, *New York* 18, *N.Y.*

New developments and improvements in electrical equipment and its application are covered in this combined work of 101 electrical engineering authorities. It includes facts and figures, systems and measurements, materials and methods and authoritative standards for all fields of electrical engineering.

Among the important developments included are radar and associated microwave technique, nuclear energy, induction and dielectric heating, new elastometers and plastics, etc. The following representative section headings indicate the *Handbook's* scope: Illumination, Industrial and Commercial Power, Electric Heating and Welding, Wiring Design, Commercial and Industrial Buildings, Electronics and Electron Tubes, Codes and Standard Practices, Prime Movers, Power Transmission, Power Distribution, Properties of Materials, Electrochemistry and Electrometallurgy.

Applied Hydrology

ELEMENTS OF APPLIED HYDROLOGY (1949). *By Don Johnstone, assistant director, W C Kruger & Associates and William P Cross, hydraulic engineer, U. S. Geological Survey.* 276 *pp, tables, illust.* $5. *The Ronald Press Co*, 15 *E* 26 *St*, *New York* 10, *N. Y.*

Even when their knowledge is limited, many engineers assume they know a lot about water, or at least about the part hydrology plays in water supply and control problems. While this book has been written for a college text, every engineer can profit from its reading. It covers practical applications of hydrology, collecting and presenting precipitation data, collecting and presenting runoff data, relation between precipitation and runoff, the role of the land, analysis of hydrographs, flood routing, infiltration theory, the hydrograph as a function of drainage-basis characteristics, and applications of statistical analysis to hydrology.

Mathematics is used in certain parts of the book, but in general the text is easy reading, well suited to those interested in what influences water supply.

Electricity for Students

ELECTRICITY FOR STUDENTS OF SCIENCE AND ENGINEERING. *By T Townsend Smith, Professor of Experimental Physics, University of Nebraska.* 448 *pp*, 234 *illust*, 9¼x6¼, $5. *International Textbook Co, Scranton* 9, *Pa.*

This book is written primarily for upperclass undergraduate students who have had a year of both general physics and calculus. Material is presented so the one who studies it will have a sound foundation for later work. There is a rather extensive treatment of electrical measurements, units and dimensions.

Text starts with the concept of an electric charge and builds up to a discussion of alternating and oscillating currents, long-line transmission, thermionic vacuum-tube circuits and electric waves. To illustrate typical scope, the chapter on *Negative Electrons* covers ions, cathode rays and negative charges, deflection of the rays by a magnetic and electric field ratio e/m of the cathode-ray particles and measurement of the charge *e*.

Metals and Corrosion

INFLUENCE OF NONFERROUS METALS AND THEIR COMPOUNDS ON CORROSION OF PRESSURE VESSELS. 45 *pp*, 6x9, $1. *Published by American Society for Testing Materials*, 1916 *Race St, Philadelphia* 3, *Pa.*

This symposium, presented at the fifty-first annual meeting of the American Society for Testing Materials, was sponsored jointly by Committee D-19 on Industrial Water and the Joint Research Committee on Boiler Feedwater Studies.

For the past three years, these committees have sponsored programs that place major emphasis on the role of mineral deposits and special methods for identifying such products.

The two papers published are: *Station Design and Material Composition as Factors in Boiler Corrosion*, by R B Donworth, betterment engineer, power stations dept, Duquesne Light Co; *Corrosion of High-Pressure Steam Generators: Status of Our Knowledge of the Effect of Copper and Iron Oxide Deposits in Steam-Generating Tubes*, by Richard C Corey, supervising engineer, combustion research section, Central Experiment Station, Bureau of Mines, Pittsburgh, Pa.

Electrical Engineering

BASIC ELECTRICAL ENGINEERING. *By George F Corcoran, Chairman of Electrical Engineering Department, University of Maryland.* 449 *pp*, 9¼x6. $4.50. *John Wiley & Sons, Inc.* 440 *Fourth Ave. New York 16, N.Y.*

This basic text is designed to lay the foundation for further study in electrical engineering, presenting the material on a mathematical level. Throughout the treatment of electric and magnetic fields, emphasis is placed on the vector properties of electric-field intensity and magnetic-flux density.

One of the features of this book is the way magnetic-field concepts are handled. For example, each magnetic or electrical concept is defined exactly at the point of its introduction. At the same time, its relation to previously discussed quantities is considered.

Arrangement of subject matter is likewise planned to suit a beginning course. First, dc theory is considered, followed by electrical-field and magnetic-field theory, inductance capacitance and nonlinear circuits.

Welding Terms

WELDING TERMS AND THEIR DEFINITIONS. *by Committee on Definitions and Charts.* 50 *pp*, 9x5¾, *paper bound*, 57 *illust*, $1, *plus a master chart of welding processes and process charts*, $0.35, *American Welding Society*, 33 *West* 39*th St*, *New York* 18, *N.Y.*

To formulate a standard terminology for welding the American Welding Society has published this book. Over 500 terms are

(*Continued on page* 156)

● Experimental laboratory condenser, with water boxes removed, designed by The American Brass Company and tubed with eight different copper alloys, as it appeared after 10-month test, July 28, 1947 to May 25, 1948, at the Marine Test Station of International Nickel Co., at Kure Beach, N. C. *(see above).*

ANACONDA Cupro-Nickel 754

(10 PERCENT NICKEL CONDENSER TUBE)

MANUFACTURED AND SOLD UNDER U. S. PATENT NO. 2,074,604

Shows High Resistance Under Accelerated Test

TEN months of testing with high velocity sea water at Kure Beach, N. C., demonstrate the superiority of Anaconda Cupro-Nickel 754 (nominal composition, copper 89.25 percent, nickel 10 percent, iron .75 percent) over a number of widely used condenser tube alloys.

The purpose of the test was to determine the resistance of various standard tube alloys to corrosion-erosion type of deterioration caused by turbulent flow of sea water. The tubes are .625″ O. D., 18 gage (.049″), and 61 inches long. The average velocity of sea water flowing through the tubes, during the continuous 10-month test, was 11.7 feet per second. Water temperature varied from 45°F. to 85°F., according to the season of the year.

This test, and performance records where Cupro-Nickel 754 tubes have been in service under severe operating conditions, indicate that this tube and tube sheet alloy will give economical service for central station and marine condensers handling clean and some types of polluted sea waters. The American Brass Company welcomes opportunities to discuss problems relating to condenser tubes, and the services of its Technical Department are available for assistance in selecting alloys to meet specific operating conditions.

ANACONDA

Anaconda

CONDENSER TUBES

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

TECHNICAL BRIEFS

ENGINEERING DEVELOPMENT HERE AND ABROAD DIGESTED FOR BUSY POWER MEN

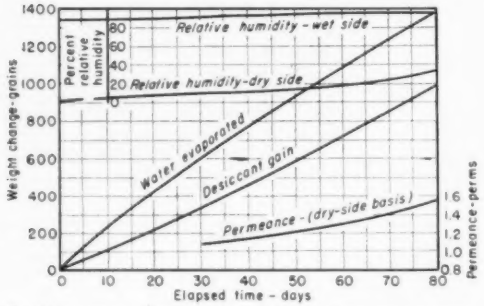
REVIEWED IN THIS ISSUE

ANTHRACITE FUELS: Anthracite as a Fuel for Synthesis-Gas Production • Industrial Utilization of Rice Anthracite

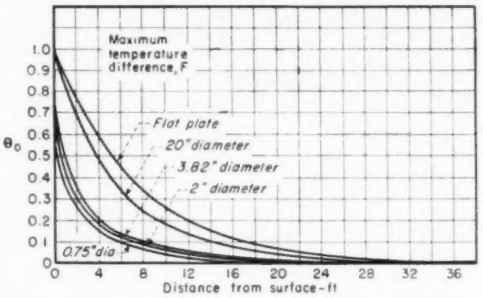
HEATING AND AIR CONDITIONING: Permeance Measurement Improved by Special Cell • Earth as a Heat Source or Storage Medium for the Heat Pump • Human Tolerance Limits for Extreme Heat • Air Distribution in Year-Round Air Conditioning

STEAM GENERATION AND MAINTENANCE: Design of Industrial Power Plants • Recent Developments in Steam Generation • Maintenance of Packaged Boilers • Preventive Maintenance Program for Small Plants

Directions for ordering papers are given on page 128



1 Water-vapor transfer through 1⅜-in. pine-wood specimen, 12 in. dia, gives above results in a special testing cell



2 Earth temperature decreases rapidly the nearer the soil is to the heat-transfer surface of any embedded ground coils

ANTHRACITE FUELS

ANTHRACITE AS FUEL FOR SYNTHESIS GAS PRODUCTION, *by Dr R C Johnson, Anthracite Institute.* The anthracite industry is currently producing about six million tons and has a storage of over 150 million tons of silt. This silt can be a fuel for the production of synthetic liquid fuels and synthetic chemicals. In addition, there are many millions of tons of anthracite bone coal that can also serve for this purpose.

These fuels are an important source of energy because they do not require opening new mines or increasing production rates of present mines. A plant using this fuel would not have to depend on current production because there are such large reserves above ground. The paper gives analyses of silt and bone coals.

It also points out that, for every ton of coal mined in 1937, 33 tons of water were pumped. The Bureau of Mines states in a 1947 report that there were 1,821,297 tons of water in the anthracite region. This information is advanced because it is held that ample water supplies must be available for any successful synthetic fuel program.

There are no costs as such included. But a comparison is made. The cost per heat unit compares favorably, claims the author, with that from natural gas at the wells. *Al Paper. No number.*

INDUSTRIAL UTILIZATION OF RICE ANTHRACITE, *by L N Burnside and A A Norrman, Delaware, Lackawanna & Western Coal Co.* Before industrial stokers became so popular, hand-fired forced-draft plants found rice coal an excellent fuel. Even with mechanical stokers employing low setting heights this coal size worked out well. With modern furnace designs this coal lost out and where anthracite is used it is usually No. 4 buckwheat.

During the war the Solid Fuels Administration requested the help of the anthracite industry in supplying coals to units being fired by bituminous coals of high volatile content and caking characteristics. To solve this difficulty admixtures of anthracite in rice size were applied. These admixtures range from 20 to 50%—with the usual one, 25%.

The Bureau of Mines reported in May 1946 that results were good. Clinkering conditions were improved. On all tests no difficulty was experienced in carrying the load. One particular plant operated with all bituminous at an average boiler efficiency of 76.6%. With an admixture of 22.5% anthracite, it reached 80.3%. Biggest single problem is assuring uniform and complete mixing of anthraoite and bituminous.

The paper advocates considering admixture of anthracite where a given fuel bed is a smoking one. *Al Paper No number.*

AIR CONDITIONING

PERMEANCE MEASUREMENT IMPROVED BY SPECIAL CELL, *by F A Joy and E R Queer, Pennsylvania State College.* Problems of humidity directly affect comfort, process or storage, and are a major concern of air-conditioning engineers. Packaging engineers, for example, choose envelope materials to retain moisture in bread and exclude it from salt. Today the packaging of living spaces gets the same attention.

Fundamental to such attention are studies of the rate of transmission of moisture through various materials—paper, paint, wood, etc—or the permeance of materials.

This paper describes a new apparatus

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HERE IS A NEW insulating fire brick that truly deserves the spotlight.

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for measuring water-vapor transmission of materials. Thick specimens as well as papers can be accommodated and the panel size, 12 in. in diameter, is large enough to be a true sample of most permeable materials. It possesses the unique feature of permitting maintenance of different temperatures when desired on the two faces of the test panel. Also, the vapor pressure can be controlled on each face at any chosen value in a wide range. Air movement may be provided over both faces of the panel. Fig. 1 shows result of sample tests run on a $1\frac{3}{4}$-in. pine-wood specimen. *ASHVE paper. No number.*

EARTH AS A HEAT SOURCE OR STORAGE MEDIUM FOR THE HEAT PUMP, *by E W Guernsey, P L Betz and N H Skan, Consolidated Gas Electric Light and Power Co, Baltimore, Md.* Future development of space heating by the heat pump depends to a considerable degree on the successful adaptation of available heat sources. When apparent difficulties with air, well water or other heat sources crop up the tendency is to look to the use of a heat exchanger buried in the earth as a promising source. This paper purports to examine critically some of the factors that could be expected to affect the practicability of earth as a heat source.

A series of calculations and curves representing these factors have been worked up for heat flow under various specified conditions and over extended periods of time when the heat supply depends solely on heat capacity of the soil and heat conduction through it.

Belief was expressed that heat capacity and thermal conductivity are the most important factors. The results, it is felt, will be directly useful as indication of ground-coil limitations for general use. For special cases, such as coils located near ground-water streams, the heat supply is not related directly to heat capacity and thermal conductivity of the soil alone. Therefore the calculations the paper gives do not apply. The soil conditions assumed were for a highly conducting, rather wet soil (25 to 30% moisture). Properties were (1) K factor—mean thermal conductivity of soil, Btu per sq ft per hr, Fahrenheit degrees per ft—0.896; (2) CP—mean specific heat of soil, Btu per lb per deg F constant over the temperature range involved—0.45; (3) p—density of soil, lb per cu ft, a constant—103; (4) a—thermal diffusivity of soil $= \frac{K}{pcp} = 0.0193$.

A further assumption called for 50,000,000 Btu of heat to be extracted from the earth annually. This corresponds to a small well-insulated house in an area where the minimum temperature is 0 F; the temperature deficiency is 4500 degree days per season; the total heating requirement is 75,000,000 Btu and the coefficient of performance of the heat pump is three. It is generally assumed for calculations that the temperature of the heat-transfer surface may deviate from the normal average earth temperature as much as 40 F.

With this as a start a number of basic calculations are made for a balanced heat extraction and return as well as for heat withdrawal only. Some estimates are made on pipe length, type of heat-transfer surface and costs in general. Fig. 2 shows how temperature varies as a result of a heat flow at the cylindrical surface of a ground coil. Maximum difference from original soil conditions decreases with increased distance from the cylinder. For a case of balanced heat withdrawal and return as against withdrawal only the pipes or cylinders can be located within short distances of one another, 20 to 30 ft. *ASHVE paper. No number.*

HUMAN TOLERANCE LIMITS FOR EXTREME HEAT, *by W V Bockley and Craig L Taylor, University of California.* With the advent of aircraft and flight, speeds in the sonic range present potential hazards of heat to occupants and to pilots. Should the plane air-conditioning system fail, air entering the cabin heats in proportion to the square of the aircraft's speed. As an example of the order of magnitude at low altitude on a 100-F summer day air temperature in the cabin at a speed of 800 mph reaches 215 F.

In an effort to get some factual results of man's ability to tolerate extreme heat an insulated cylinder, 70x46-in. dia, with a total volume of 70 cu ft was set up. Ventilation and heating are accomplished by a blower, a flow-metering system and a 9-kw electric heat exchanger.

Air flow through the chamber is distributed over its horizontal cross-section by a floor baffle-plate system. Its equivalent linear velocity, directed vertically from seat to head of the subject, averaged 41 fpm as measured with a thermal anemometer. The ventilation volume rate was maintained, as a matter of routine, at 70 cfm with exhaust air discarded.

Twenty-one human exposures to air temperatures ranging from 140-240 F are reported. Physiological measurements include skin, rectal and air temperatures, heart rate, and body-weight losses. Graphically displayed are relationships between air temperature, exposure time, and an index of physiological strain, composed of heart rate and skin temperature. A comparison is made between the actual tolerances times and this index, as well as the extrapolated tolerance times from studies made at the ASHVE laboratory in the early 1920's when it was in Pittsburgh. *ASHVE paper. No number.*

AIR DISTRIBUTION IN YEAR-ROUND AIR CONDITIONING, *by G L Ture, Case Institute of Technology, Cleveland, Ohio.* Best single gage of how successful an engineer has been on air distribution within a room is whether the general public is unaware of the distribution. Noticeable drafts are indications of poor engineering no matter what the system—cooling, air conditioning, warm air heating or just ventilation.

The designer has full control of air streams from supply outlets but can do very little about air flow to return or exhaust grilles. When an air stream discharges into a free-open space its velocity is reduced in two ways: (1) by impact of moving air particles against quiet room air (2) by a viscous friction or drag nearer the periphery of the air stream where the Reynolds number is below the critical for turbulent flow.

Velocity gradients in a free air stream are marked by three zones—a constant velocity one near the outlet, a short transition zone and, finally, out in the room, a zone of considerable length where residual velocity decreases in direct proportion to the distance from the discharge outlet face.

The mixing ratio of room air entrained with supply air is proportional to distance from the outlet. Temperature gradient between primary and room air is negligible when stream velocity is reduced to about 100 fpm.

The balance of the paper discusses kinds of outlets and air distribution patterns from them. *MWP Paper.*

(*Continued on page 152*)

TO OBTAIN COMPLETE TEXT

Material for these abstracts comes from one of the following sources: American Society of Heating and Ventilating Engineers' mid-year meeting, Minneapolis, Minn. June 21-23, 1949. Papers are identified by initials ASHVE. Obtainable through ASHVE, 51 Madison Ave, New York 10, N. Y.

Anthracite Conference of Lehigh University, seventh annual meeting, May 5-6, 1949, Bethlehem, Pa. Papers are identified by initials AI. Obtainable through Lehigh Univ, Bethlehem, Pa.

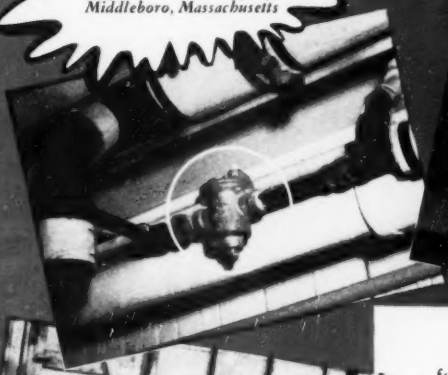
Midwest Power Conference, annual meeting, Chicago, Ill. April 18-20, 1949. Papers available through the Illinois Institute of Technology, 3300 S Federal St, Chicago 16, Ill. Papers identified by initials *MWP.*

ARMSTRONG TRAPS KEEP HEATING SYSTEMS

hot and healthy!

1. Save Fuel
2. Reduce Maintenance
3. Provide Fast Heat-Up
4. Insure Continuous Service
5. Help Avoid Corrosion

NO MAINTENANCE IN 6 YEARS on 350 Armstrong traps draining 15 lb. heating system, including unit heaters, coils, radiators, steam mains and headers. *Plymouth Shoe Company, Middleboro, Massachusetts*



10-15% REDUCTION IN HEAT-UP TIME, trap maintenance costs reduced 50%, since installing Armstrongs to drain the 5 psi heating system to a 10" vacuum return at *John Deere Ottumwa Works, Ottumwa, Iowa.*

SAVES 20% ON FUEL, since installing Armstrong Blast Traps with thermic air vents to drain heating coils at *Norton Greenhouses, St. Paul, Minnesota.*

***THESE TWO USEFUL HANDBOOKS** for engineers, contractors and pipe fitters tell how and why Armstrong Steam Traps will rejuvenate your heating system:

1. **HOW TO SELECT STEAM TRAPS FOR UNIT HEATERS** by the BTU Method and Condensate Weight Method; tables of BTU outputs of heaters produced by 24 manufacturers; installation methods, tables and charts.

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POWER NEWS

BUSINESS ITEMS • APPOINTMENTS • FOREIGN FIELDS
WASHINGTON NOTES • NEW DEVELOPMENTS • CONVENTIONS

High-Voltage Lab Creates Powerful Lightning Bolts

► THE MOST POWERFUL lightning bolts ever created by man ripped through the air as the new high-voltage engineering laboratory of General Electric Co was opened officially on June 23. The newly developed 5000-kv generators will be put to use in study of effects of lightning on electrical equipment. Ultimate aim is to reduce manufacturing costs and increase dependability of transformers, rotating equipment, distribution and transmission lines.

Artificial Lightning. Julius H Hagenguth, engineer in charge of the laboratory, supervised the firing of artificial lightning with a peak of 15,000,000 v. The discharge occurred across a 50-ft gap between two generators in the huge demonstration hall of the laboratory, described as "the world's largest man-made lightning center."

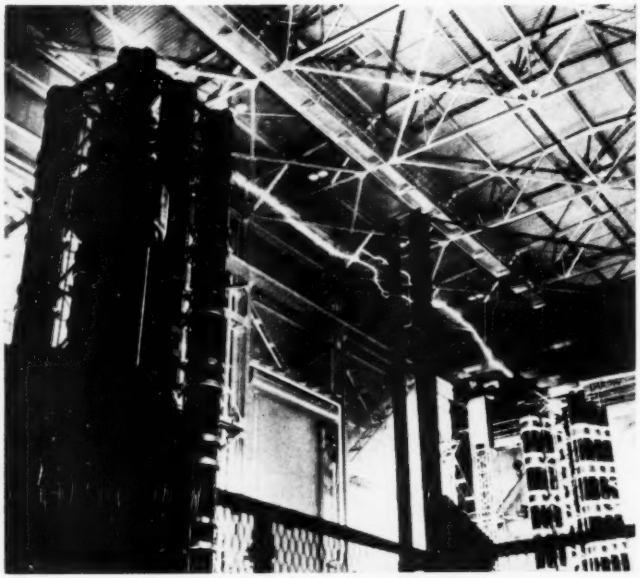
The high-voltage engineering laboratory is used by GE engineers to conduct basic research into effects of lightning and other high-voltage electric discharges on power-transmission lines and to study means of protection from lightning.

A substation capable of supplying the normal electric needs of a community of some 10,000 people is required to operate the testing equipment.

Laboratory Division. The laboratory is divided into four main parts: (1) high-voltage hall, where powerful surges of artificial lightning are made (2) low-bay building, where tests are run on various types of equipment (3) controlled-temperature laboratory, in which high-voltage tests are conducted under varying degrees of temperature and humidity (4) the offices, including a lecture room, five photographic darkrooms, chemical and physical laboratories, mechanical and electrical workshops, and other special test rooms.

High-voltage hall, which measures some 165 ft in length and 85 ft in height, contains the two 5,100,000-v impulse generators that are capable of producing a peak of 15,000,000 v between them, the transformers, and controls used to produce the powerful strokes of lightning. No conventional windows are in the large room, as the

(*Continued on page* 190)



A 15,000,000-v bolt of lightning, the most powerful ever created by man, leaps 50 ft between two impulse generators in the high-voltage engineering laboratory of General Electric Co. This is the longest distance attained with man-made lightning

COMING EVENTS

Aug 23-26—National Assn of Power Engineers, 67th annual convention, Hotel Sherman, Chicago, Ill. A F Thompson, director, 176 W Adams St, Chicago, Ill.

Sept 12-16—Instrument Society of America, convention, Municipal Auditorium, St. Louis, Mo. Richard Rimbach, secretary, 1117 Wolfendale St, Pittsburgh 12, Pa.

Sept 26-28—National Electronics Conference, meeting and exhibit. Edgewater Beach Hotel, Chicago, Ill. Karl Kramer, secretary, Jensen Mfg Co, Chicago, Ill.

Oct 3-4—National Assn of Corrosion Engineers, south central region meeting. Adolphus Hotel, Dallas, Texas. G R Olson, United Gas Pipe Line Co, Box 1407, Shreveport 92, La.

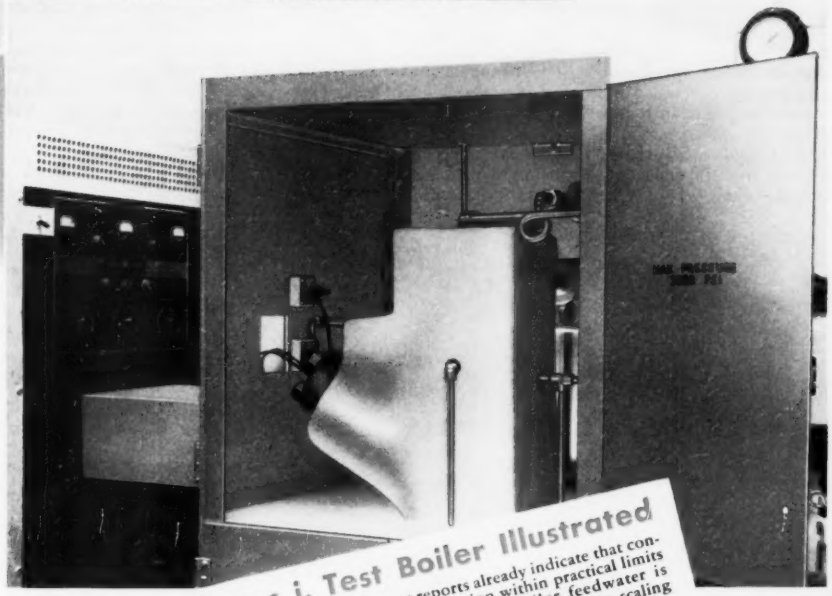
Oct 3-5 — National Lubricating Grease Institute, annual meeting, Hotel Roosevelt, New Orleans, La. Harry F Bennetts, NLGI, 4638 Mill Creek Parkway, Kansas City 2, Mo.

Oct 16-21—American Welding Society, 1949 annual meeting, Hotel Cleveland, Cleveland, Ohio. M M Kelly, secretary, American Welding Society, 33 W 39th St, New York 18, N. Y.

Oct 17-21—National Metal Congress and National Metal Exposition, Public Auditorium, Cleveland, Ohio. Walter Morrison, 7301 Euclid Ave, Cleveland 3, Ohio.

Nov 14-18—Refrigeration Equipment Manufacturers Assn, 6th all-industry air-conditioning and refrigeration exposition, Atlantic City Auditorium, Atlantic City, N. J. George E Mills, show director, 1346 Connecticut Ave, Northwest, Washington 6, D. C.

Preparing for Your FUTURE



Data on 3,000 p.s.i. Test Boiler Illustrated

- Maximum operating pressure 3,000 p.s.i.
- Electronically heated by 15 KW, 540 KC induction coil, adjustable to produce varying heat transfer rates.
- Estimated maximum heat transfer rate per square foot of heating surface: 250,000 B.t.u. per hour. (Heat transfer rates in excess of 200,000 B.t.u. per square foot per hour are routine at 3,000 p.s.i.)
- Present reports already indicate that continuous operation within practical limits is possible when boiler feedwater is Nalco treated to prevent foaming, scaling and corrosion.
- Automatic controls, essentially the same as those on modern steam generators.
- Feedwater pre-heated and deaerated; steam condensed and returned to hot well.

YOUR future water treatment, whether your boilers operate at 25 or 2,500 p.s.i., is being prepared for in the Nalco Laboratories today. Tremendously accelerated scaling and corrosion tests, possible with this 3,000 p.s.i. test boiler, are only a small part of the continuous Nalco program of pioneering in all phases of water treatment chemistry.

Where bold experimentation is indicated, Nalco initiates it—and *proves results* in a practical manner before offering new methods and materials to industry. This policy works for you in several ways: you can be sure that the Nalco System used in your plant is not just a laboratory experiment . . . Your water treatment program will be based upon securing results—not upon chemical sales as such . . . And you can be certain that all new developments and improvements coming from the Nalco Laboratories will be used to the best advantage wherever they may apply in your plant.

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THE *Nalco* SYSTEM...Serving Industry through Practical Applied Science

How to plan a

LOCALIZED HOT WATER SUPPLY USING STEAM-COLD WATER MIXERS

Another in the series of basic Piping Layouts prepared by Jenkins Bros.

In some industrial plants, installation of hot water piping throughout the building is unwarranted and uneconomical. Tenants, however, can provide their own hot water in limited areas by several methods. One of the most common and inexpensive, where cold water and live steam lines are available, is to install steam-cold water mixers.

These are generally small in size (up to 1" or 1½"), and are used to supply hot water for wash rooms, chemical processes, sterilizing, heat exchangers, etc. In general, steam-cold water mixers can be regulated as to hot water outlet temperature and contain a safety feature which prevents water temperatures from exceeding a preset maximum. In most cases, it is more economical to install several mixers throughout the plant, each to perform a specific job within its immediate location, rather than a single mixer which requires hot water piping to all points of use.

The accompanying diagram shows the installation of two mixers with piping connections. Installation of strainers in all lines to the mixers prevents accumulation of scale and dirt and thus prolongs mixer life. Though not all users install the steam trap at the end of the steam feed, many have found this arrangement more satisfactory. Draining the condensate away with the trap, especially when no hot water is being used, keeps live steam at the mixer inlet, and avoids lost time in arriving at desired outlet temperature.

Jenkins PRACTICAL PIPING LAYOUTS

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A Use the right type valve for the service.
B Place valves correctly in the line.
C Choose Jenkins Valves for lifetime economy.

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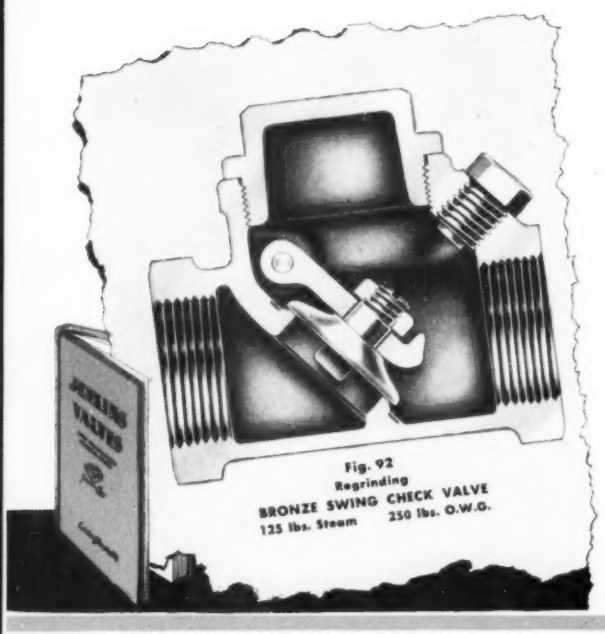

Fig. 92
Regrinding
BRONZE SWING CHECK VALVE
125 lbs. Steam 250 lbs. O.W.G.

The check valve recommended for this layout is the Fig. 92, Jenkins Regrinding Bronze Swing Check Valve. Since steam and water pressures of about 100 pounds are common in industrial plants, the valves selected are based on this pressure rating. In general, steam and water pressures will differ and the use of check valves just prior to the mixer is practical. These checks prevent backup and mixing of the steam and cold water in the feed lines. The Fig. 92, with a 45° seat, will remain tight even at extremely low pressures, and its high tensile bronze disc can be reground easily without removing the valve from the line.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installations.

A CHOICE OF OVER 500 VALVES

To save time, to simplify planning, to get all the advantage of Jenkins specialized valve engineering experience, select all the valves you need from the Jenkins Catalog. *It's your best assurance of lowest cost in the long run.*

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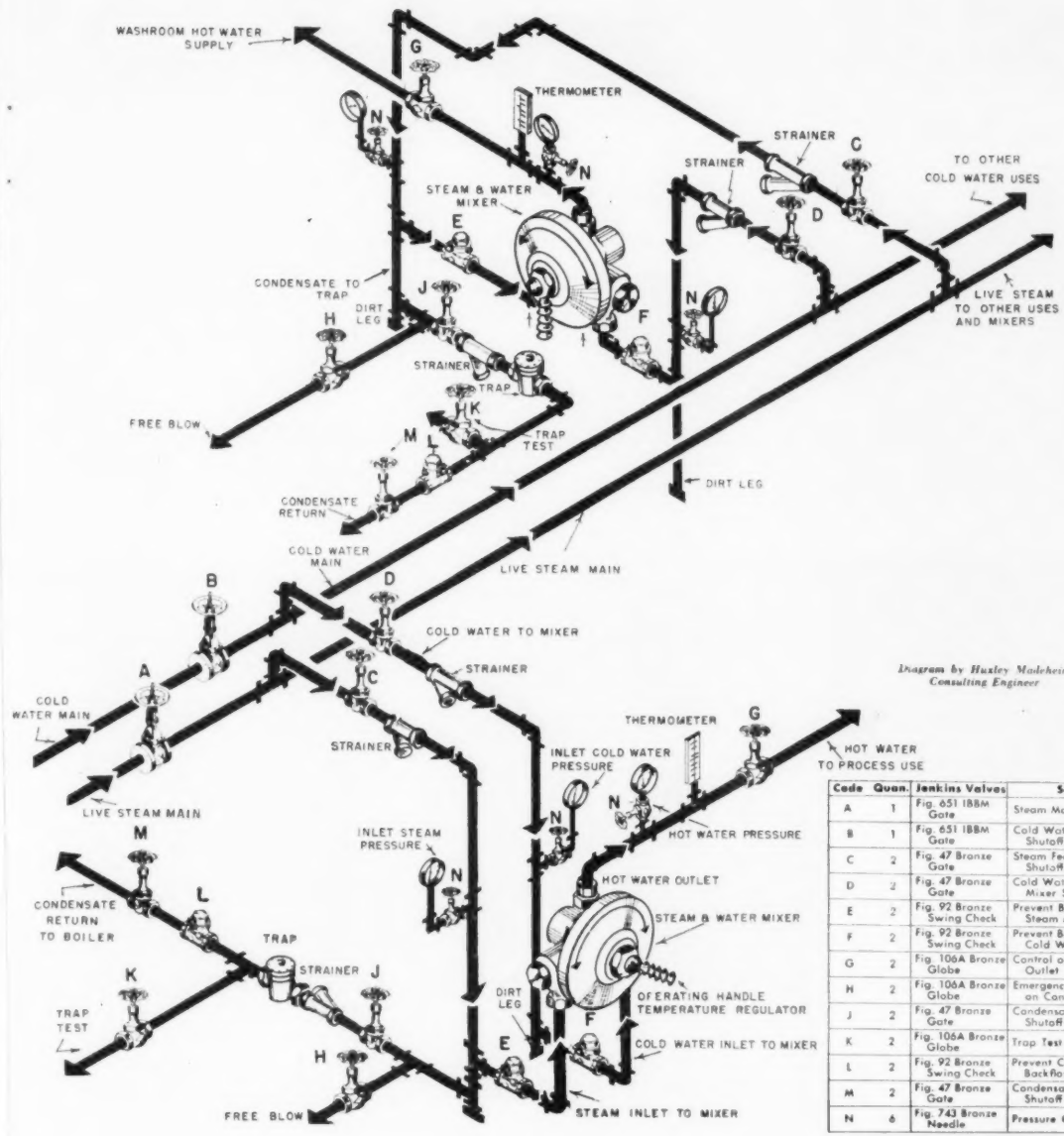

Diagram by Huxley Madeheim Consulting Engineer

Code	Quan.	Jenkins Valves	Service
A	1	Fig. 651 IBBM Gate	Steam Main Shutoff
B	1	Fig. 651 IBBM Gate	Cold Water Main Shutoff
C	2	Fig. 47 Bronze Gate	Steam Feed to Mixer Shutoff
D	2	Fig. 47 Bronze Gate	Cold Water Feed to Mixer Shutoff
E	2	Fig. 92 Bronze Swing Check	Prevent Backflow to Steam Main
F	2	Fig. 92 Bronze Swing Check	Prevent Backflow to Cold Water Main
G	2	Fig. 106A Bronze Globe	Control on Hot Water Outlet
H	2	Fig. 106A Bronze Globe	Emergency Free Blow on Condensate
J	2	Fig. 47 Bronze Gate	Condensate Trap Shutoff
K	2	Fig. 106A Bronze Globe	Trap Test
L	2	Fig. 92 Bronze Swing Check	Prevent Condensate Backflow
M	2	Fig. 47 Bronze Gate	Condensate Return Shutoff
N	6	Fig. 743 Bronze Needle	Pressure Gage Control

VALVE RECOMMENDATIONS
For details and valves to suit varying conditions see Jenkins Catalog

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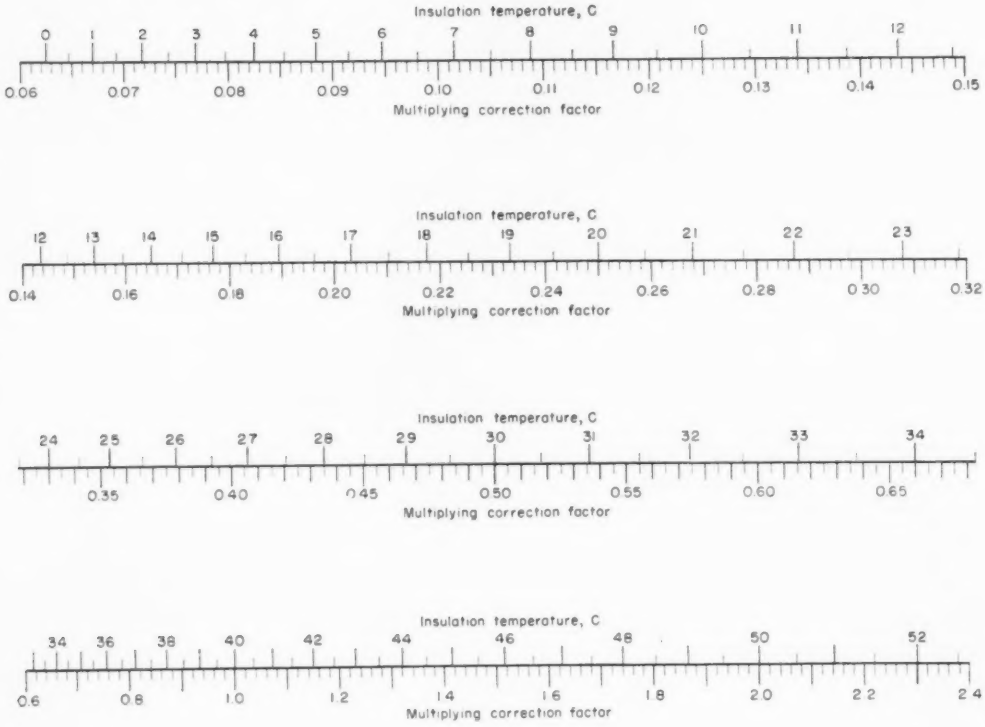

Insulation temperature, C
0 1 2 3 4 5 6 7 8 9 10 11 12
0.06 0.07 0.08 0.09 0.10 0.11 0.12 0.13 0.14 0.15
Multiplying correction factor
Insulation temperature, C
12 13 14 15 16 17 18 19 20 21 22 23
0.14 0.16 0.18 0.20 0.22 0.24 0.26 0.28 0.30 0.32
Multiplying correction factor
Insulation temperature, C
24 25 26 27 28 29 30 31 32 33 34
0.35 0.40 0.45 0.50 0.55 0.60 0.65
Multiplying correction factor
Insulation temperature, C
34 36 38 40 42 44 46 48 50 52
0.6 0.8 1.0 1.2 1.4 1.6 1.8 2.0 2.2 2.4
Multiplying correction factor

Insulation Resistance Varies With Temperature

► INSULATION RESISTANCE, usually found with a megohmmeter, ordinarily doubles with each 10 C drop in temperature. Hence readings taken at different temperatures must be corrected to one common or base value in order to be properly comparable. These scales give the correction factor for each temperature to correct the test reading to its value at 40 C.

Example: A transformer winding insulation resistance is found to be 120 megohms when its temperature is 18 C. What would be its resistance at 40 C?

In the scales find the correction factor of 0.2175 for 18 C. Then insulation resistance at 40 C = $120 \times 0.2175 = 26.1$ megohms.

To convert insulation resistance to its value at some other temperature than 40 C, first multiply by the proper factor to correct to 40 C and then divide this value by the correction factor corresponding to the desired temperature.

Example: When insulation resistance is 823 megohms at 26 C what will be its magnitude at 20 C?

Correction factor from 26 to 40 C = 0.379

Correction factor from 20 to 40 C = 0.250

Insulation resistance at 20 C

$$= \frac{823 \times 0.379}{0.250} = 1247 \text{ megohms}$$

By Carl Kind & Ray Buchan, St. Louis, Mo.

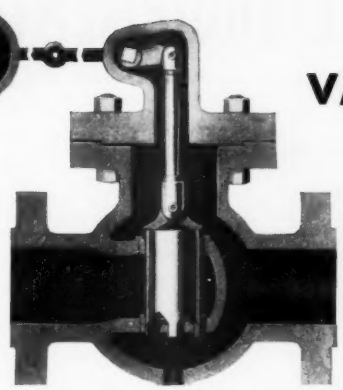
COPES BALANCED VALVES

Wherever you use float valves, avoid losing any of your operating force in the stuffing box. Insist on low and constant valve stem friction.

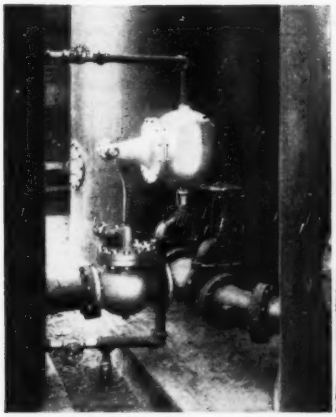
Make sure of instant, accurate response to your actuating force—no matter what your flows and pressures—by demanding close control of the unbalanced forces found in every valve.

Provide for minimum pressure losses at high flows by requiring your valve ports to be accurately designed for the conditions you specify.

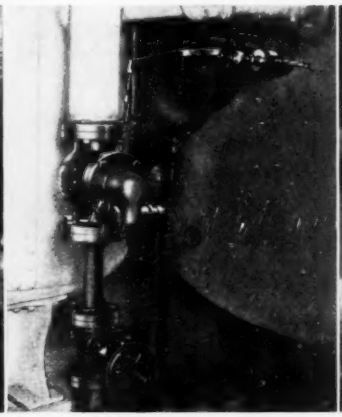
In other words—insist on COPES Balanced Valves. They offer all these important advantages—plus long service life with minimum maintenance. Write in detail about your needs.



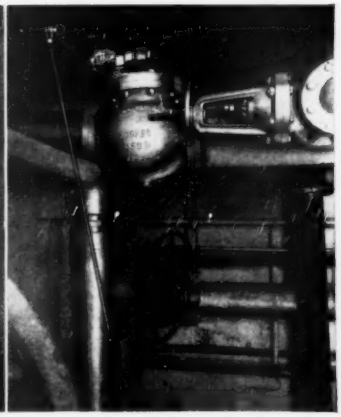
With the COPES Type BI Valve, rotating stem means low stuffing box friction. Accurate balance assures quick and accurate response. Exact capacity you need is provided.



Float-operated COPES Type BI Valve controls flow of condensate from flash tank to storage tank.



Flow of blow-down water from a flash tank is controlled by this float-operated COPES Valve.



Water level in a deaerating heater is controlled by this float-operated COPES Balanced Valve.

NORTHERN EQUIPMENT COMPANY
891 GROVE DRIVE, ERIE, PA.

BRANCH PLANTS: Canada, England, France, Italy and Austria. *Representatives everywhere.*

Bulletin 443-B gives condensed data on all major COPES products. Write for a copy—your letterhead, please. Keep it for reference.

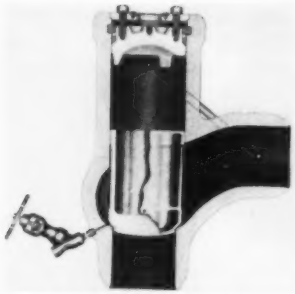
COPES

Headquarters for . . .

Boiler Feed Water Control . . . Excess or Constant Pressure Control, Steam or Water . . . Liquid Level Control . . . Balanced Valves . . . Desuperheaters . . . Boiler Steam Temperature Control . . . Hi-Low Water Alarms.

PLANT EQUIPMENT NEWS

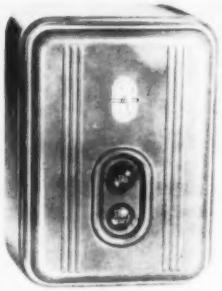
Published monthly as a service to readers



P861 • CHECK VALVE—Newly designed cast-steel valve body makes smaller, more economical check valve installations possible. Design is said to reduce pressure loss 40%, so that one size smaller check valve will do the work. It also saves space, weight and turbulence. Bodies are built for 900, 1500 and 2500-psi classes, with both globe and angle patterns.

Smaller body size is achieved by use of integral Stellite seat and Edward equalizer, which allows the disk-piston to rise completely out of path of flow, thus utilizing entire flow passage.

Edward Valves, Inc, Subsidiary of Rockwell Mfg Co, East Chicago, Ind.



P812 • MOTOR STARTER—*Bulletin* 3151 across-the-line starter is for service with single or polyphase ac motors. Manual starter has mechanically actuated quick-make-and-break switch mechanism with thermal overload protection.

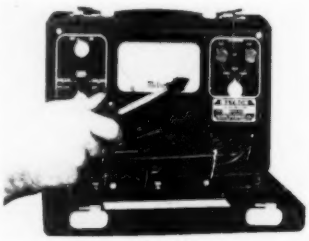
Device features front-operated, silver-to-silver double-break contacts, manually reset inverse time-delay thermal overload, interchangeable overload heaters, and provision for padlocking.

Ward-Leonard Electric Co, Mt. Vernon, N. Y.

P843 • SLEEVE BEARING — A pre-lubricated sleeve bearing compensates for both parallel and angular misalignment, reduces transmission of noise, and provides for shock absorption. The pillow-block uses an *Oilite* bearing enclosed in a bushing or shell of neoprene, the latter contained in a base of stamped, welded steel.

While lubrication need be added at only infrequent intervals according to the use, the lubricant in bearing can be renewed as required by simply applying a few drops of oil directly to bushing itself. Mounting for entire assembly is of cadmium-plated steel so that it may be used without other protection against normal rust. It is available from stock in most of the popular smaller shaft sizes beginning at ¼ in. dia.

Bushings, Inc, Coolidge Highway at 14 Mile Road, Royal Oak, Mich.



P811 • TACHOMETER—Type 48*K* is equipped with ranges especially suited for motor and generator testing. Total speed range without adapters is 360 to 4,000 rpm. Head adapters are available for checking speeds at either extreme.

Any one of ten ranges is instantly selected by a rotary switch. No damage results from over-speeding to about 8000 rpm, regardless of range setting. Readings are accurate on all ranges to within ¼% of actual speed.

Metron Instrument Co, 432 Lincoln St, Denver 9, Colo.

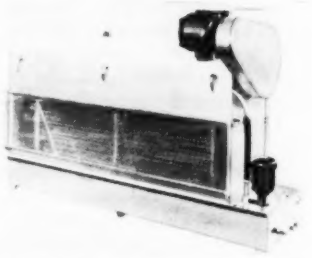
P802 • WIRE CONNECTORS — Kit contains an assortment of nearly 400 bakelite-type wire connectors. Known as Cat. No. 346, this package contains sufficient connectors to handle hundreds of wire combinations ranging from 3 No. 18 to 3 No. 10 solid or stranded wires.

Holub Industries, Inc, Sycamore, Ill.

P822 • SPEED-CONTROL UNIT — Complete assembly includes two variable-pitch sheaves and controls to handle 1- or 2-hp, 6-1 speed ratio. Spring-loaded sheave is mounted on motor shaft, while control sheave is mounted on driven shaft.

Changes in pitch diameter cause standard V-belt to actuate spring-loaded motor sheave, giving stepless speed control over 6-1 range. Remote control may be easily applied.

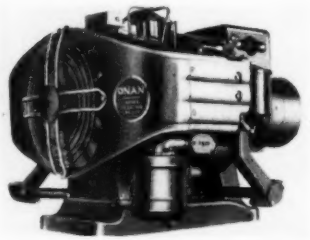
Speed Selector, Inc, 118 Noble Court, Cleveland 13, Ohio.



P830 • EVAPORATIVE CONDENSER—New line of evaporative condensers—5 to 40 ton capacity—has welded-steel angle iron and heavy steel for frame and sump pan, hot-dipped galvanized after fabrication. Inside surfaces are bitumastic covered.

Standard features include fiber-glass eliminator sections in the 20 to 40 ton units for positive removal of entrained water droplets before they enter the fan section. Centrifugal pumps, in the 5 to 15 ton units, have inlets at bottom of sump to avoid air binding.

Bush Mfg Co, Hartford, Conn.



P864 • DIESEL SET—Opposed 2-cylinder air-cooled diesel powers 5000-watt ac diesel-electric set with integral shock mountings that permit operation right on floor, without bolting or special base. Over-all dimensions are 38¾x30¼x26⅛ in. Weight is about 725 lb, without batteries. Model 5*DRP* is available for 60 or 50 cycles, all standard voltages, and is adaptable to portable applications.

Two intake manifolds have built-in electric heaters, battery supplied, to reduce cranking time on cold starts. Unit has forced-pressure lubrication, two oil-bath air cleaners and primary and secondary fuel filters. The direct-connected 5-kw generator is of saturated-field design and self-

For further data on above items use reply cards on page 182a, identifying your request with letter *P* and number

the SOURCE you can depend on for all your Piping Needs

How CRANE is set up to give you better service

ONE SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY

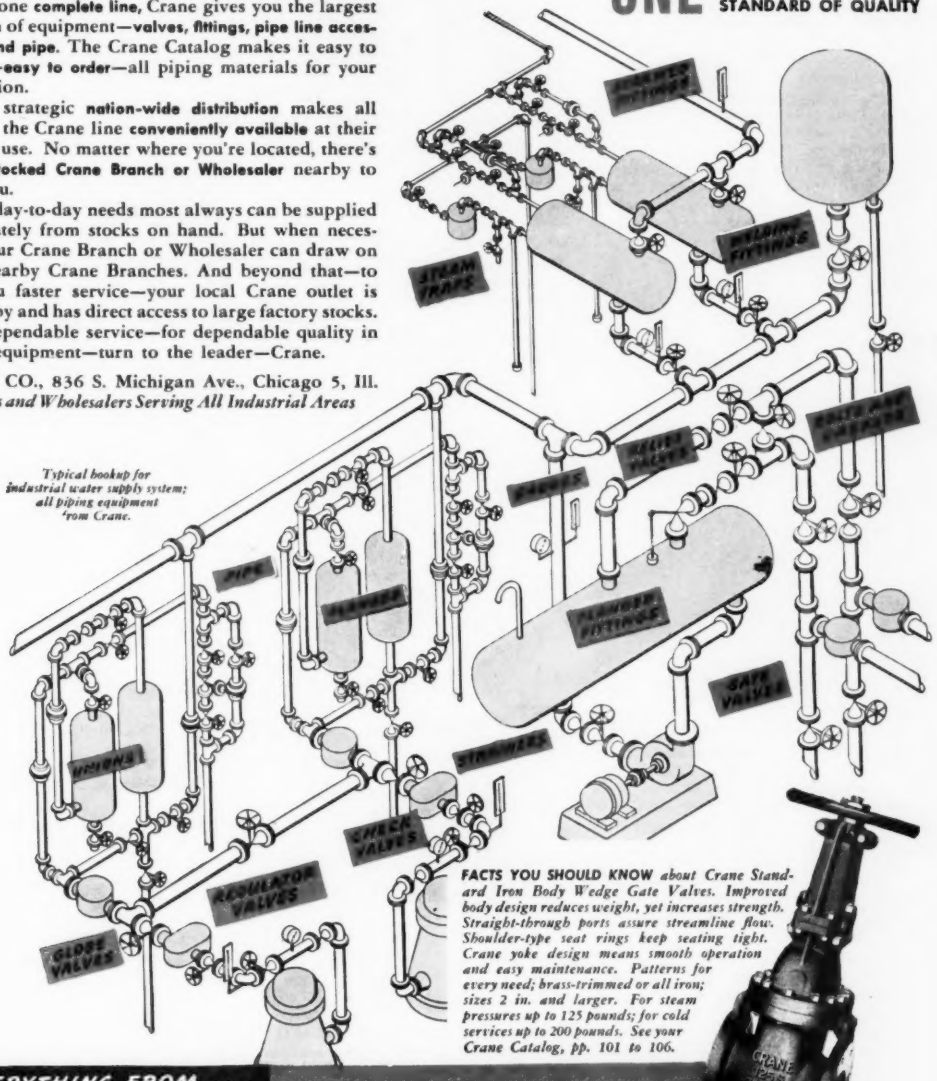
Take the water supply piping shown here, for instance. First, in one **complete line,** Crane gives you the largest selection of equipment—**valves, fittings, pipe line accessories, and pipe.** The Crane Catalog makes it easy to specify—**easy to order**—all piping materials for your installation.

Next, strategic **nation-wide distribution** makes all items in the Crane line **conveniently available** at their point of use. No matter where you're located, there's a **well-stocked Crane Branch or Wholesaler** nearby to serve you.

Your day-to-day needs most always can be supplied immediately from stocks on hand. But when necessary, your Crane Branch or Wholesaler can draw on other nearby Crane Branches. And beyond that—to give you faster service—your local Crane outlet is backed by and has direct access to large factory stocks.

For dependable service—for dependable quality in piping equipment—turn to the leader—Crane.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas



Typical hookup for industrial water supply system; all piping equipment from Crane.

FACTS YOU SHOULD KNOW *about Crane Standard Iron Body Wedge Gate Valves. Improved body design reduces weight, yet increases strength. Straight-through ports assure streamline flow. Shoulder-type seat rings keep seating tight. Crane yoke design means smooth operation and easy maintenance. Patterns for every need; brass-trimmed or all iron; sizes 2 in. and larger. For steam pressures up to 125 pounds; for cold services up to 200 pounds. See your Crane Catalog, pp. 101 to 106.*

EVERYTHING FROM . . .

VALVES • FITTINGS
PIPE • PLUMBING
AND HEATING

CRANE

FOR EVERY PIPING SYSTEM

EQUIPMENT NEWS CONTINUED

regulating without additional controls. Two 6-volt starting batteries are provided.
D W Onan & Sons Inc, Minneapolis 5, Minn.

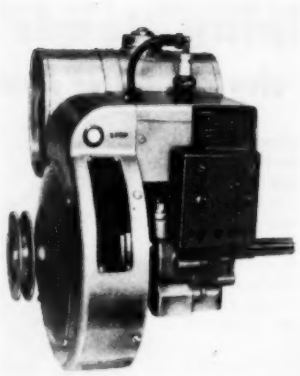
P837 • CORK COVERING—Self-curing, brush or trowel-applied, new material serves as an adhesive or a finish for corkboard or cork covering. It protects insulation from solvent products. *Solvopruf* sets to a rubber-like film at room temperature and remains as such through temperatures ranging from —35 F to + 125 F.

After aging for six or seven days, coating is resistant to toluol, methyl ethyl ketone, gasoline, kerosene and water. Material is manufactured immediately prior to application. It is not to be stored.
Armstrong Cork Co, Lancaster, Pa.

P807 • VOLTAGE TESTER — New magnetic polarity cap, for existing line of voltage testers, contains a 2-color magnet on rotating shaft. One of tester prods is red, the other black. When red portion of magnet is up, the red tester prod is positive; when black portion is up, the black prod is positive.

Cap may be purchased separately and used on earlier type testers.
Square D Co, 6060 Rivard St, Detroit 11, Mich.

P839 • TEST BENCHES — Eighteen different all-steel unit test benches, including drawers, cupboards sinks, tables, storage cases, etc, are designed to be joined easily one to another to form benches either 30 or 36 in. high. Units are two, three, four or five feet in length and have plastic-impregnated stone, called *Kemrock*, for working surfaces.
Fisher Scientific Co, 714 Forbes St, Pittsburgh 19, Pa.



P867 • LIGHT ENGINE—Designed for industrial applications where lightness and compactness are important, air-cooled gasoline engine, weighing only 19 lb complete, develops 4 hp at 4000 rpm and 3 hp at 3000. Over-all dimensions are 9½x 11½x13 in. high. Homelite No. 20 engine can be used either horizontally or vertically.

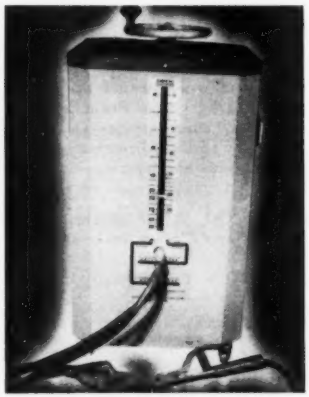
All major castings are die-cast aluminum alloys. Two-cycle design holds moving parts to minimum: there are no exhaust valves and only one rotary intake valve, which is self-seating and needs no adjustment. Built-in governor, part of rotary intake valve, controls engine speed. Simple float-feed carburetor comes with or without throttle. Main and crankpin bearings are double-row ball design; wrist-pin has needle bearing. Ignition is by high-tension *Wico* magneto.
Homelite Corp, Port Chester, N. Y.

P818 • AUTOMATIC LUBRICATOR—Unit lubricates trolley wheel bearings and pins on a twin-type conveyor. Unit lubricates both bearings at the hubs on inside and outside of the wheels.

As each pair of trolley wheels passes the lubricator, a trigger is tripped that automatically releases oil fog jets directly into wheel bearings. Air from the plant line is stepped down to proper operating pressure, about 40 psi.
J N Fauver Co, 49 W Hancock St, Detroit, Mich.

P848 • FLUID-FLOW METER—Type *H* meter, using orifice nozzle or Venturi tube, indicates and records on uniformly divided scales.

Bell-shaped float, in mercury acted upon by differential pressure, moves in exact proportion to actual flow, thus avoiding unequal scales.
Simplex Valve & Meter Co, 68th & Upland St, Philadelphia 42, Pa.



P823 • DOUBLE-DUTY WELDER—Standard 200 v *Eutecarc* machine features a smooth, stepless control for quick, easy adjustment of current.

Unit, 17x17x32 in., mounts on casters for mobility. It permits welding both light and heavy gage materials on the one machine. Ampere rating ranges from 20 amp to 285. Electrode sizes run from 1/16 to ¼ in. dia.
Eutectic Welding Alloys Corp, 40 Worth St, New York 13, N. Y.

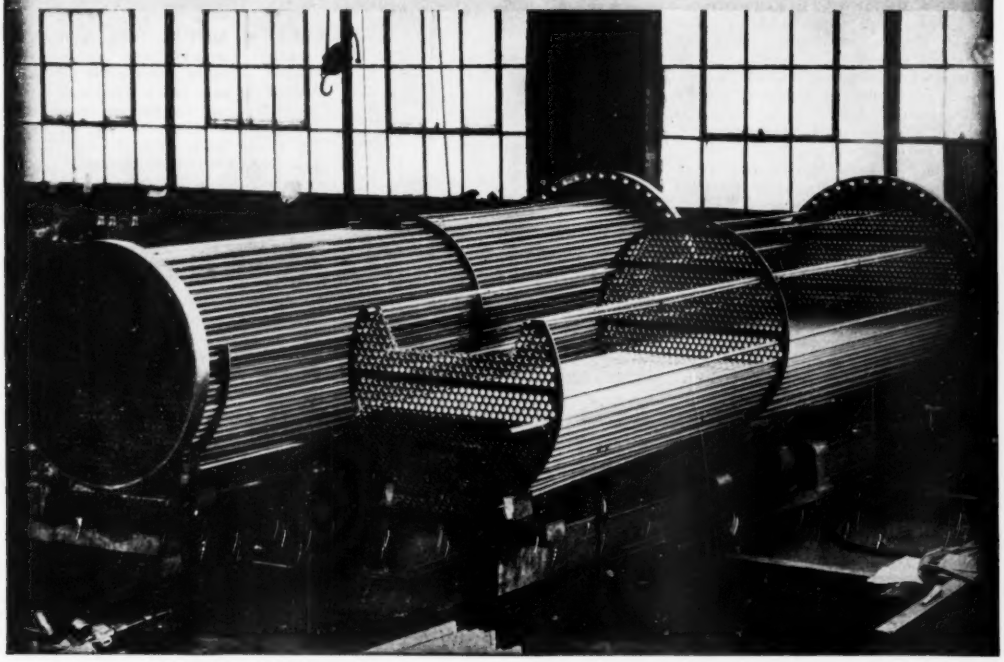
P813 • PRESSURE SWITCH—Switch indicates pressures ranging between 10 and 25 psi. Unit is designed to make or break contacts at an accuracy of plus or minus ¼ psi.
Electric Auto-Lite Co, Toledo 1, Ohio.

P863 • HIGH - TEMPERATURE VALVE—New 36 x 8 in., 150 psi, Class B, steel dual valve operates at 1000 F. It is operated by a separate electric motor.

Body casting is of chrome-moly steel. Each alloy steel vane is operated independently of the other, ensuring close control of volume and pressure. Called valve No. 725, it is designed for either a high-pressure drop and small volume, or a low-pressure drop and large volume, thus operating beyond limitations of a single

For further data on above items use reply cards on page 182a, identifying your request with letter P and number

IT'S IMPORTANT TO KNOW ALL THE FACTORS AFFECTING CONDENSER TUBES



In selecting condenser tubes it is often the case that such conditions as temperatures, pressures, and compositions of the gases and fluids will be taken into account fully, only to have the tubes thus chosen give short service. In such cases, it is wise to call in Revere and ask for a thorough check of the situation before assuming that the wrong alloy was specified.

Here is a case in point. Admiralty tubes in a high stage condenser in a refinery were lasting only three or four months. In the effort to increase life, the sour gas had been treated, but as no improvement was experienced, the treatment was discontinued. The Revere Research report, made after laboratory investigation, stated that Admiralty metal was the correct alloy and its use should be continued, but that microscopic study of a failed tube showed definite and conclusive evidence of fatigue corrosion, probably due to vibration. A conference with the people at the plant revealed that the condenser vibrated considerably. Hence the obvious recommendations: cut down the vibration by better bracing, resume treatment of the gas, and continue to use Admiralty tubes. These recommendations were followed, and when last checked the new Admiralty tubes had been serving for eight months and were still going.

The Revere Technical Advisory Service is eager to serve all users of condenser tubes and plates through close collaboration in the study of difficult problems.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere.

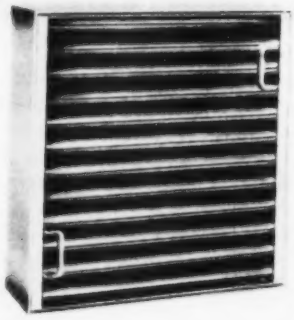
valve. Valve is available in all materials in various combinations of sizes and for higher pressures.
Valve Div, R S Products Corp, Wayne Junction, Philadelphia 44, Pa.

P826 • WELDING ELECTRODE—High-speed tack welds on heavy weldments may be made with Class *E*-6020 electrode, Hobart No. 384, without breaking excess coating from end of the electrode on starting or restarting welding arcs. Usually, merely touching the end of the electrode to the work piece restarts and maintains the arc.

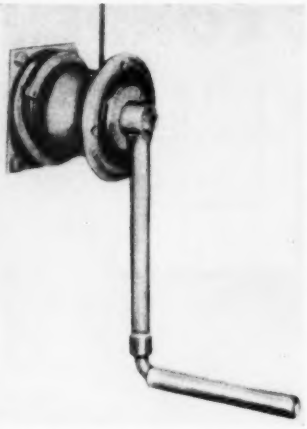
Coating has sufficient dielectric strength to withstand scraping without arcing through. Electrode is available in 14-in. length in ⅛, 5/32, 3/16 in. sizes and in 18-in. length in ¼-in. size, packed in 50-lb standard containers.
Hobart Brothers Co, Troy, N. Y.

P804 • CURRENT TRANSFORMER—Low-voltage instrument transformer is for indoor service with one or two watthour meters. One high-voltage terminal has provision for potential connection to meters. Type *KLW* is available in 200, 400 and 600-amp ratings.

Two terminal blocks have a shorting device requiring no tools to operate: clamp-type connectors for the outgoing leads facilitiate meter connection. Position of shorting device may be seen through transparent cover that can be sealed in either posiiton.
Allis-Chalmers Mfg Co, 952 S 70th St, Milwaukee, Wis.



P831 • AIR-RECOVERY UNIT—Self-contained, activated-carbon-cell air-recovery unit, 24x24x8¾ in. deep, can handle up to 1000 cfm. "Accordion-pleat" perforated filter element has a 28-sq-ft face area in a space of less than 3 ft. The activated carbon can absorb over 5 lb of impurities in the return air, making it possible to recirculate or recover considerable of the already conditioned return air.
W B Connor Engrg Corp, 114 E 32nd St, New York 16, N. Y.



P844 • GENERAL-PURPOSE WINCH—Compact, planetary gear-type winch, built as a separate unit for industry, has all the mechanism contained within winch drum, completely protected from dust and moisture.

Winch drum is 4 in. in diameter, its flanges 6 in., and the over-all length 6¼ in. Compact construction is obtained by use of high-strength heat-treated alloy steel. The crank handle is 12 in. long and the hand grip can be swung out of the way when not in service. The direct cable pull is 600 lb and each revolution of the crank winds up 3 in. of cable. A positive-acting brake holds load securely in position and prevents spinning of handle when crank is being turned in reverse direction for lowering load.
Lewis-Shepard Products, 268 Walnut St, Watertown 72, Mass.

P849 • COMBUSTIBLE GAS DETECTOR—Lor-Ann industrial-type combustible gas detector continually samples and analyzes hazardous plant atmospheres. When gas content creates danger of fire or explosion, device sounds bell or siren, or both, and flashes neon light—also automatically takes over control of plant operating machinery, fire-fighting system, ventilation system, or all, as locally arranged.

Heavy-duty rotary vane suction pump draws sample from danger points. Alarm can be set at from 20 to 100% of lower explosion concentration limit. Meter gives constant reading of gas concentration. Lor Ann runs on 110 v, 60 cycle.
Lor Ann Instrument Co, 58 Montgomery St, Jersey City, N. J.

P808 • BATTERY VENT PLUG—*Televel* tells at a glance whether battery needs water. Translucent plug has a cylindrical element projecting into electrolyte.

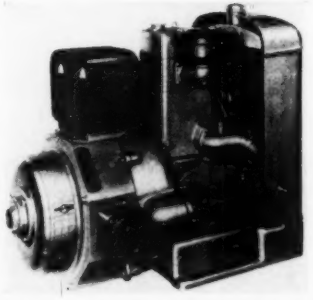
When no water is required, top of plug shows a black circle. Deflected light rays show a white circle on the plug top when water is required.
Gould Storage Battery Corp, Trenton, N. J.

P806 • MOTOR INSULATION—Irv-O-Slot insulation uses a newly developed binder for bonding the varnished cambric to paper stock. Binder will not harden with age nor ooze out under heat. Standard laboratory tests for delamination of slot insulation is 95 hr at 125 C.
Irvington Varnish & Insulator Co, 6 Argyle Terrace, Irvington 11, N. J.

P838 • RUST-PREVENTIVE—Colorless, tasteless water compound, *Borgana*, is made from the vegetable compound resulting from the distillate of cedar-log waste. It is said to neutralize carbonates and organic growth and inhibit scale-forming elements of magnesium carbonate and sodium chloride.
Portland Shingle Co, Portland, Ore.

P833 • PROTECTIVE JACKETING—Metal-jacketing for insulated pipelines is lightweight aluminum, ribbed for extra strength with 3/16-in. corrugations. Jacketing is flexible enough so No. 471 plastic film Scotch tape holds the aluminum covering in place.

Plastic tape stands up under weather and dampness. It withstands heat up to 170 F and cold down to sub-zero.
Childers Mfg Co, 625 Yale St, Houston, Texas.



P869 • DIESEL GENERATOR—Model 45 diesel, rated 5¼ hp at 1800 rpm, is offered as a power unit with 3-kw ac or dc generator, or as a marine propulsion unit with reduction gears. Engine is heavy-duty vertical type, 4-cycle solid-injection, full diesel.

It has full-pressure lubrication, removable cylinder sleeve, removable cylinder

For further data on above items use reply cards on page 182a, identifying your request with letter *P* and number

CARNEGIE-ILLINOIS STEEL CORPORATION'S modern power plant, built on single-contract by Dravo, provides 180,000 cfm of blast air for the newest furnaces at Edgar Thomson Works and generates 62,500 kva of electric power for the entire family of Carnegie-Illinois mills in the Monongahela Valley. This is but one of 45 major power projects handled by Dravo in the past ten years.

DRAVO
CORPORATION

DRAVO BUILDING, PITTSBURGH 22, PA.

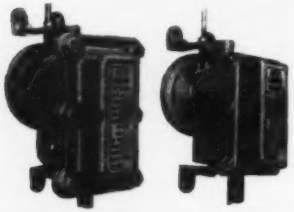
Engineering constructors of power-plants, boiler plants, central stations, compressor stations, water pumping stations. Fabricators and erectors of power piping. Machinery installation. Power and boiler plant equipment.

PITTSBURGH · PHILADELPHIA · CLEVELAND · NEW YORK · DETROIT

head containing valves and combustion chamber, cast alloy-iron crankshaft, easily accessible injection pump. Special features of the generating set include power-line-failure automatic starting, automatic remote-station starting and load-demand starting. For hand-cranked applications, Model 45 engine is equipped with a 2:1 cranking device. Unit can be furnished with radiator or heat-exchanger cooling.

Cylinder dimensions are 3⅛x4 in.; displacement is 30.8 cu in. Combustion chamber is *Lanova* type. Main bearings are Timken tapered roller; connecting rod has steel-backed babbitt-lined precision bearings; wristpin is bronze bushed. Aluminum piston has three compression rings and one oil ring. Injection nozzle is of pintle type; pump is constant stroke.

Fairbanks, Morse & Co, 600 S Michigan Ave, Chicago 5, Ill.



P850 • EXPLOSIONPROOF PRESSURE CONTROL—New Coral design control also gives dustproof and splashproof sensitive action. It serves in hazardous locations in chemical plants, grain elevators, distilleries, oil refineries, etc.

It is designed for very low-pressure applications. Control is rated up to 20-in. water column with differential two-tenth inch to 2 in. It can control static pressure in intake of duct, measure and actuate an alarm when pressure drop across an air filter reaches some predetermined value.

Coral Designs, Forest Hills, N. Y.

P854 • HAMMER BIT—*Thunderbolt* carbide-tipped hammer bit drills hard concrete and granite and may be used in any type of electric hammer. Manufacturer claims great savings in drilling cost and bit replacement.

It is available 3/16 to 1 in., inclusive. Chucks are available to fit drill and any make of electric hammer.

New England Carbide Tool Co, 60 Brookline St, Cambridge 39, Mass.

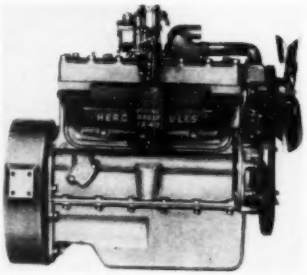
P835 • WELDING ELECTRODE — Versatile, ac or dc, electrode has high tensile strength, 85,000 to 95,000 psi, and excellent heat and corrosion-resistance. *All-State* No. 252 is applied by preheating the base metal to 300-500 F. Weld has a yield strength of 50-60,000 psi, elongation 35-45% and reduction of area 35-50%.

All-State Welding Alloys Co, 273 Ferris Ave, White Plains, N. Y.

P834 • SERVICE COCKS — High-pressure self-lubricated service cocks for gas, oil or water lines up to 125-psi working pressure have cast-iron bodies and bronze plugs. Available in ¾ and 1 in. sizes, design features tamperproof construction.

Plug is always held against its seal in the body by a gland through resilient packing. Top is closed by means of a screw-type bronze gland that requires a special spanner wrench.

Walworth Co, 60 E 42nd St, New York 17, N. Y.



P865 • GASOLINE ENGINES—For general-purpose power application, 4-cyl *JX4* series includes: Model *JX4E*, 3½x4¼-in., 164-cu-in. displacement; Model *JX4C*, 3¾x4¼-in., 188 cu-in.; Model *JX4D*, 4x4¼-in. 214-cu-in.

Crankshaft is counterweighted and Tocco-hardened, carried in five main bearings of precision type. Main bearings are brass-backed babbitt-lined; crankpin bearings, also precision type, are steel-backed, copper-lead lined and lead plated. Aluminum-alloy pistons carry four rings, all above the wrist-pin. Exhaust valves have austenitic heads welded to hardened nickel-steel stems. Intake valves are one-piece chrome-nickel-steel forgings. Both have removable guides.

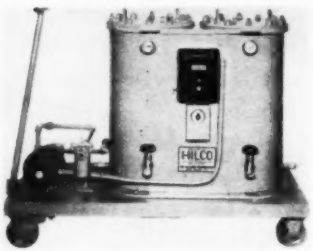
Oversized gear-type oil pump provides pressure lubrication to main and rod bearings, idler bearings and oil-pump drive gear. Cylinders have full-length water jackets. Valve passages are designed so valve seats and stems receive maximum cooling. Packless-seal water pump has high capacity, positive gear drive.

Hercules Motors Corp, Canton, Ohio.

P821 • OIL CONDITIONER — Designed for turbine or other low-viscosity high-demulsibility oils containing rust or oxidation inhibitors, oil conditioner is available in four sizes to serve steam turbines from 1000 to 110,000 kw. Unit removes solid particles as small as 20 microns in size with active catalysts and oil deterioration.

Second step provides filtration for removal of particles to 1 micron in size, as well as moisture or vapor cloud. Free water is precipitated and ejected with an automatic device.

Bowser, Inc, Fort Wayne, Ind.



P803 • PORTABLE OIL FILTER—Unit consists of a filter assembly with or without electric heater and filter passages packed with fuller's earth or cellulose, depending on oil to be filtered. Unit is suitable for wheeling up to diesel engines or other equipment containing lube oil that requires periodic filtering.

Motor-driven pump withdraws oil from equipment, passes it through the filter cartridge, and then back into the oil system. Unit is 24x36x36-in. high and has a capacity from ½ to 4 gpm. Units of higher capacity are also available.

Hilliard Corp, 102 W 4th St, Elmira, N. Y.

P815 • CLASS B INSULATION—Varnished *Fiberglas* insulation has high dielectric strength and good flexibility. New principle is used in weaving the base cloth. New weave permits better penetration of insulating varnish between cloth fibers.

Style *OW* is available in 0.007-, 0.010-

(*Continued on page* 146)

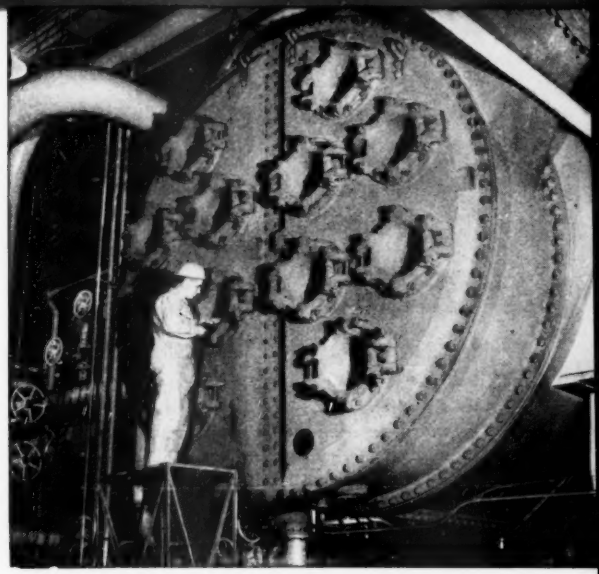
For further data on above items use reply cards on page 182a, identifying your request with letter *P* and number

DOWELL

SPECIALISTS IN SCALE AND SLUDGE REMOVAL WITH CHEMICALS

clean condensers rapidly—

the chemical way!



Engineers responsible for power plants in many industries know that *clean* condensers and boilers are important factors in *keeping down costs.*

To help you keep down costs and maintain designed operating efficiency in many types of heat exchange equipment, Dowell offers a fast, reliable chemical scale removal service which has been proved in thousands of successful cleaning jobs.

Dowell engineers fill the equipment with liquid solvents designed to dissolve and disintegrate the scale and sludge deposits which retard heat transfer. Dismantling is unnecessary; down time is reduced to a minimum.

Dowell engineers are experienced, know which solvents to use, and have the necessary equipment—special truck-mounted tanks, pumps, heaters and chemical proportioners—to make possible control of each stage of the job.

To clean condensers, boilers, many other types of heat-exchange equipment, water lines and water wells—call Dowell. Ask for literature and a prompt estimate on *your* job.

DOWELL INCORPORATED · TULSA 3, OKLAHOMA

SUBSIDIARY OF THE DOW CHEMICAL COMPANY

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New York 20	Buffalo 2	Kansas City 8	Mt. Pleasant, Mich.
Boston 16	Cleveland 13	Wichita 2	Hamilton, Ohio
Philadelphia 2	Pittsburgh 19	Oklahoma City 2	Charleston 27, W. Va.
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Wilmington 99	Chicago 2	New Orleans 12	Borger, Texas
Richmond 19	St. Louis 8	Ft. Worth 2	Midland, Texas
Jacksonville	Indianapolis	Shreveport 23	Wichita Falls, Texas
Atlanta	Louisville	Anniston, Alabama	Lafayette, La.

Long Beach, Oakland, Casper: Dowell Associate-International Cementers, Inc.

DOWELL

A SERVICE ORGANIZATION

How to Reduce Plant-Operating Costs

The words "Reduce Costs" or "Cost Reduction" don't have a pleasant ring for some people. I guess it's because they imply the firing of employes, or cutting of salaries. What we'd like to talk about is cutting the cost of such things as power-plant maintenance, a kilowatt-hour and a pound of steam.

The real obstacle to better business conditions today seems to be that the buyer is holding off till prices drop. He's pretty firm in his attitude, and it's up to power men to help bring the cost of goods and services down by cutting power costs. All of us will agree that this is necessary, but as I travel around, I see relatively few power men doing anything about setting up good, resultful cost-reduction programs. And why? Because of these hurdles:

Pride. This is largely psychological. We take pride in enlarging, expanding, turning out more pounds of steam per hour than last year or last week. Instinctively, we dislike cost reduction because it smacks of retreat rather than progress. It definitely conflicts with the American way of measuring accomplishment by the ton, the yard or the square foot.

Fear. "Why stick your neck out?" seems to be an all-too familiar question. Cost-reduction often involves buying capital equipment—such as a new coal-handling system or water-treatment outfit—and the power superintendent sticks his neck out to make his recommendation for purchase. If the plan succeeds and the new equipment pays for itself three times over in five years, 15 guys claim the credit. If the plan fails, the man who proposed it is *never* forgotten.

Complacency. This comes in several forms. For instance, one type of engineer is always talking about making a study of heat losses in his plant to determine whether it will pay him to do a new insulation job—but instead he always has ten other things to do. Or, there is the guy who says, "It worked good enough last year—so what's wrong with it now?"

Lack of Plan and Organization. The previous obstacles were mental; this is physical. If there isn't a broad over-all plan, the program will dwindle to selecting only a few minor things of the many that ought to be done. Achieving lower power costs is just plain hard work, requiring fine organization, good technical knowledge, and eternal questioning.

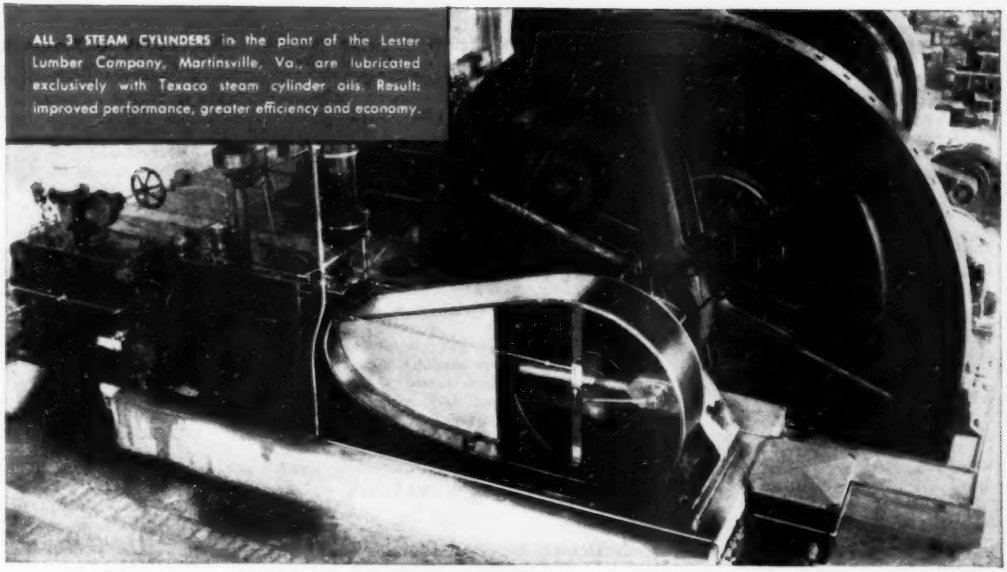
Some experts predict we're heading into stormy times. A far greater number say there's more real buying power in the country than ever before—to move forward, we've got to shake off the war-born fat and get prices down to the point where buyers are attracted again. We can help a great deal by making our plants more efficient, by getting rid of outmoded expensive equipment, by establishing better operating and maintenance procedures—all of which a careful cost-reduction study will show up.

The problem, simply stated, is this: Reduce costs now, or be reduced by costs later!

George Edwards

Engineer

EDITOR'S NOTE: *We're just as aware of the need for cost cutting as George is. So, we've planned a 16-page Special Section, full of practical tips on saving power dollars. Watch for it in October!*



ALL 3 STEAM CYLINDERS in the plant of the Lester Lumber Company, Martinsville, Va., are lubricated exclusively with Texaco steam cylinder oils. Result: improved performance, greater efficiency and economy.

"They... assure steam-tight rings and minimize wear"

AND, adds Mr. G. T. Lester, Jr., President, "We have found Texaco steam cylinder oils entirely satisfactory. They are better than any oils previously used ... and have been a big factor in the trouble-free performance of our steam engines."

THERE are Texaco steam cylinder oils to give you these same benefits—steam-tight rings, minimum wear, trouble-free performance—whatever your operating conditions.

Texaco steam cylinder oils are designed to atomize completely, to cling to cylinder walls . . . assuring full protection for pistons and cylinders, maximum efficiency and economy from your engine, new or old.

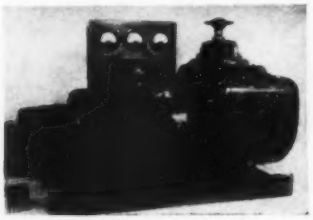
Let a Texaco Lubrication Engineer help you select the right Texaco steam cylinder oils for your particular conditions. Just call the nearest of the more than 2300 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO

TEXACO Steam Cylinder Oils

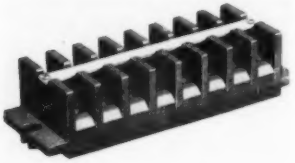
FOR EVERY OPERATING CONDITION

and 0.012 in. It is manufactured in black and yellow, in various sizes.
Irvington Varnish & Insulator Co, Irvington 11, N. J.



P872 • STANDBY POWER PLANT—These machines are powered with one-, two- and four-cylinder air-cooled engines that make them suitable for standby power because there are no radiator and anti-freeze solutions. Generators will take care of starting single-phase ac motors that may require five times running current for starting.

Illustration shows model 49*HAW* 4, 10-kw 110/220-v 60-cycle 1800-rpm ac revolving-field generator powered with a Wisconson *VP4*, 29-hp four-cylinder air-cooled engine.
Kato Engrg Co, Mankato, Minn.



P873 • TERMINAL BLOCK—An electrical terminal block, known as the *Add-A-Point*, eliminates wasted points and provides an unlimited number of circuit terminations. Simplified assembly procedure permits addition of points at any time after installation.

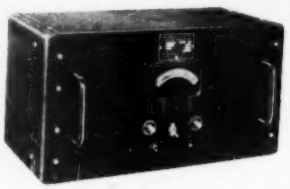
Rated at 60 amp, they can be operated safely up to 750 v, and test voltage even higher. They are suited for junction box, steel panel, machine tool and switchboard mounting.
Wama Co, Industrial Bldg, Baltimore, Md.

P874 • HIGH - RESISTANCE SEALING — Oil-resistant, plastic-flow *Felseal* gives a low-cost, efficient sealing compound for gaskets or joints on cast and machined parts.

Modified polysulphide elastomeric coating can be applied in film thicknesses of .001 to .005 in. It resists attack by mineral or vegetable oils, fats or soaps, aliphatic or aromatic hydrocarbons, dilute acids and bases. It has a high plastic flow under moderate pressures to seal castings and machined parts effectively without using a finishing cut or surface grinding.
Felt Products Mfg Co, 1508 Carroll Ave, Chicago 7, Ill.

P868 • DIESEL LUBRICANT—*Ursa Oil Super Duty*, available in SAE grades 10 and 30, is designed to reduce corrosive wear and ring-groove deposits in high-speed diesels. It is recommended for use with fuels having sulphur contents of 0.5% or higher, and for severe operating conditions. It is approved against U. S. Army Specification 2-104B.

Blending a special additive with a mineral oil refined from carefully selected crudes yields a product claimed to have good extreme pressure and lubricating properties under conditions approaching thin-film boundary-type lubrication. It also possesses excellent anti-foaming and rust-inhibiting properties.
Texas Co, 135 E 42 St, New York, N. Y.



P875 • VOLTAGE REGULATOR — Having a 2-kva output the *Stabiline* type *EM* 4102 regulator is electromechanical in operation. Heart of the unit is a variable-voltage transformer controlled by an electronic detector.

Unit will correct within input voltage range of 95 to 135 v in three sec. Output voltage is adjustable between 110 and 120 v. The unit has an output current rating of 20 amp.
Superior Electric Co, 25 Hannon Ave, Bristol, Conn.

P814 • FLOODLIGHT—Besides advantage of higher lighting levels concentrated in narrow beams, new fixture retains all standard features of medium and wide beam *L*-69's. Beam angle is 20-deg vertical and 24-deg horizontal; maximum beam candlepower is more than 400,000.

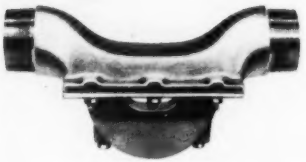
Unit has a heat, weather and impact-resistant front glass that is sealed to aluminum reflector. The floodlight serves in long, narrow areas.
General Electric Co, Schenectady 5, N. Y.

P829 • DRY SURFACE COOLING—Finned-tube dry-surface cooling equipment circulates fluids through finned tubes while air is forced or induced across the tubes with a large fan. Frame is sheet asbestos covered redwood or steel.

Unit comes in three basic designs: (1) induced draft with vertical or horizontal heat-transfer surface on two sides (2) induced-draft horizontal heat transfer surface under the fan (3) forced-draft horizontal heat-transfer surface over the fan.
Marley Co, Kansas City 15, Kansas

P876 • PRE-LUBRICATION — Synthetic colloidal graphite dispersion *dfg*—123, allows a low cost pre-lubrication of engine parts before assembly.

A special applicator kit No. 5123*A* includes a spray gun, twelve 8-oz cans of *Miracle Power*—a lubricant—one qt and one 8-oz bottle of *dgf*—123 and a qt of carbon tetrachloride. The trigger-operated spray gun may be easily recharged with any standard air line tire chuck or hand pump.
A P Parts Corp, AP Bldg, Toledo 1, Ohio.



P877 • PIPELINE SEPARATOR — Permanent magnet trap stops tramp-iron damage to processing equipment, such as pumps, screens, grinders, etc. It is available in 2-, 3- and 4-in. sizes and may be ordered with either flanged or threaded ends.

Magnetic element is made up of one or more U-shaped alnico magnets permanently attached to a fused stainless-steel faceplate. It is good for pressures up to 75 psi. Trap housing is usually of bronze. Also, the unit can be furnished in cataract metal, a copper-nickel base alloy developed especially to resist acids, alkalies, mixtures, organic compounds, etc.
Eriez Mfg Co, 748 East 12th St, Erie, Pa.

P878 • BATTERY CHARGER — To operate, connect battery to charger and snap toggle switch to "on." Push white button on charge-control unit for lead batteries or set amp-hour meter for Edison batteries. The charging current is con-

(*Continued on page* 170)

For further data on above items use reply cards on page 182a, identifying your request with letter *P* and number

3 REASONS WHY CHAPMAN STEEL VALVES *are your best buy*

1. **The high-precision ratings of custom-made valves—at production line prices.**
2. **Made from quality-controlled steels developed and produced in Chapman's own foundries under strictest metallurgical control.**
3. **Designed to meet A.S.A. and A.P.I. Standards in all pressure and temperature ranges.**

Whenever you need Steel Valves—gate, globe, angle, or check—come to Chapman first. Backed by years of research, development and performance, Chapman Steel Valves are your guarantee of better . . . longer service.

The Chapman Valve Mfg. Co., Indian Orchard, Massachusetts

QUALITY in world famous W-S Forged Steel Fittings starts with proper selection of basic metals. Long before problems of forging, machining and testing arise, W-S technicians concern themselves with end uses in the determination of proper steel analysis for the various jobs Fittings must perform.

For example, working closely with Refinery engineers, W-S technicians helped establish standards for the physical properties of various fittings alloys . . . were first to use fitting materials of closely controlled uniformity (low sulphur-low phosphor) for the special demands of refinery services.

And, W-S has kept pace with changing methods in other processing industries too, meeting each new challenge with stronger, tougher alloys, producing forged fittings always correct — metallurgically.

They meet the broad, diversified needs of all industry and are available in both screw and socket weld types. Forged and precision machined of stainless, carbon and alloy steel . . . . Investigate.

WATSON-STILLMAN

ROSELLE, NEW JERSEY

• ESTABLISHED 1848 •

D-J-34

SOLD THROUGH LEADING DISTRIBUTORS

ELECTRONICS

(Continued from page 114)

Turning on and off the room-illumination system involves two problems. As daylight decreases below a given intensity the phototube turns on the room lights. Then room-light intensity is above normal, because it is the result of daylight coming in and that from the lighting system. This intensity would turn off the lights again unless prevention means are provided in the relay.

The reverse of this occurs when daylight is increasing, as in early morning. The photoelectric relay has to be prevented from turning off the lights until outside light can illuminate the room at a normal intensity. We will see how these problems are solved in Fig. 11.

The relay has three sets of contacts. One is closed and the other two are open when the relay is deenergized. Closed contacts K short circuit resistor R_2 in series with the lighting-circuit magnetic-contactor coil M. Assume the room dark when the lighting relay is connected to its power source.

Lighting Contactor. The lighting-contactor coil M connects directly across the primary terminals of the relay transformer. With the transformer polarity shown, the circuit is from −, through coil M, relay contacts K resistor R_3 and to + terminal. Energizing coil M closes contact K_3 to turn on the room light.

A minus bias is maintained on tube E grid by grid rectification. One part of this circuit is from S_3 on the transformer through potentiometer P to S_2. Current also flows from A through resistor R_1, the cathode, the grid, which acts as an anode, resistor R, to charge capacitor C_1 of the polarity shown.

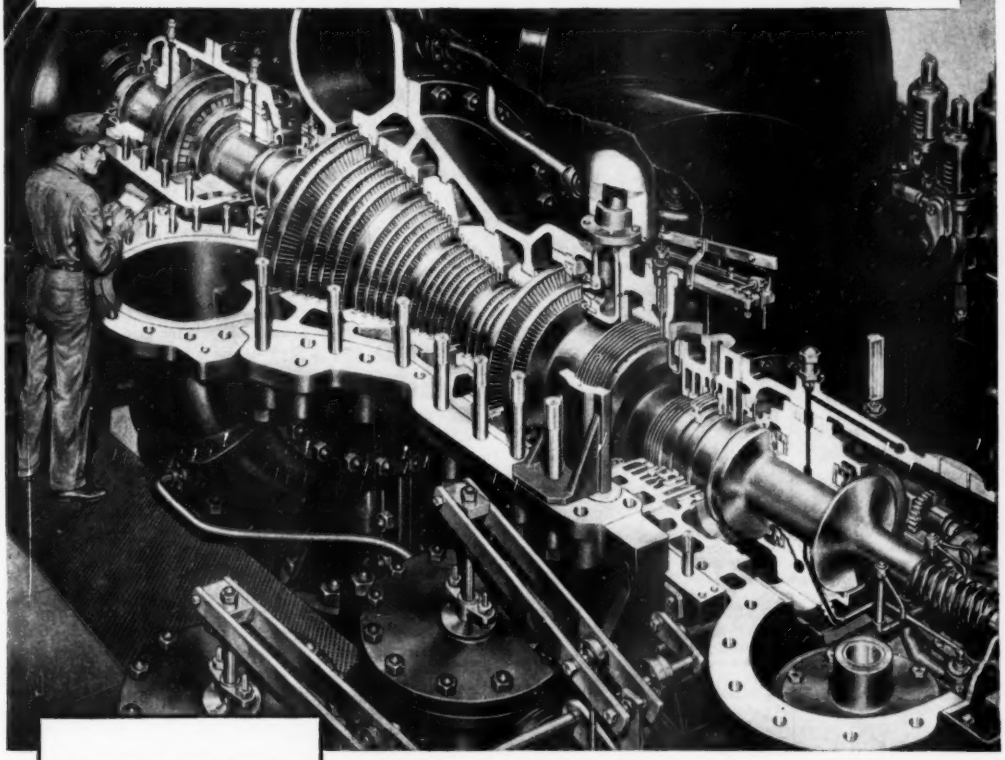
When transformer polarity reverses, capacitor C_1 tends to discharge from the grid to the cathode to maintain a minus bias on the former. Since light shines on the phototube's cathode, capacitor C_1 can also discharge through this tube and the transformer from S_3 to S_2 and to + on the capacitor. With only normal room light reaching the phototube it is not conductive enough to discharge capacitor C_1 and reduce the grid bias to where enough current flows through E to operate the relay.

This cannot occur until room illumination is raised above normal by incoming daylight. Until this occurs capacitor C_1 is charged by grid rectification on one half of each cycle and partly discharged on the other half through the phototube.

Grid Rectification Voltage. Voltage available for grid rectification is that across potentiometer P from A to B, which is a large part of that across transformer S_3S_4. This is necessary to

635 TURBINES

Set Records with Gargoyle D.T.E. Oil 797



FAMOUS SOCONY-VACUUM TURBINE OIL PROVED OVER 7-YEAR PERIOD!

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Practically Half of All New Units Getting this Great Product

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Now it's in 635 turbines—Gargoyle D.T.E. Oil 797. And it's setting performance records undreamed of a few years ago. In seven years, not a single turbine taken out of service because of the condition of the oil. No appreciable change in the oil. But no wonder—this great product is made from a base stock that is in itself an excellent turbine oil with natural resistance to oxidation and foaming. To this stock, we've added still greater resistance to oxidation . . . and maximum protection against rust. It's one of the best, the safest turbine oil ever developed. Put it in your turbine now.

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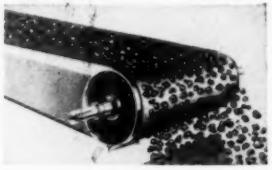
GENERAL PETROLEUM CORPORATION

Rely on **SOCONY-VACUUM** *Correct Lubrication*

RECOMMENDATIONS ON MAGNETIC SEPARATORS for taking Tramp Iron out of Coal

THERE is a Dings Magnetic Separator for every power plant or boiler room requirement . . . from the big 48" x 48" electromagnetic pulleys used by modern central stations to the little Alnico Perma-Plate magnets for plants using small stoker-fired heating boilers. Detailed descriptive literature and recommendations from Dings engineers are available on request to help you select the separator best suited to your needs.

MAGNETIC PULLEYS

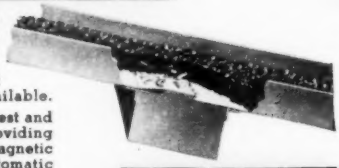


Magnetic Pulleys are recommended on the majority of belt conveyor installations because they *automatically* remove and discharge the tramp iron.

NEW! THE ALNICO PERMA-PULLEY—magnetic permanence *guaranteed* for the life of the installation . . . powerful, trouble-free. Suitable for most pulley requirements. Ask for Catalog C-1007A.

AIR-COOLED ELECTROMAGNETIC PULLEY—recommended for very heavy burdens because of great depth of magnetic flux penetration. Catalog C-1001A.

RECTANGULAR ELECTROMAGNETS



Uniform magnetic flux pattern across entire face of magnet, plus great depth of magnetic penetration and high surface strength, make Dings triple pole rectangular magnets the most powerful tramp iron magnets available.

CHUTE TYPE—stepped face helps arrest and hold iron mechanically as well as providing extra magnetic edges for intense magnetic concentration. Available with automatic safety gate to stop flow if current is interrupted; gate also used to remove accumulated iron. Catalog 301-A.

SUSPENDED TYPE—recommended for use above belt where pulley is not applicable due to excessive speed, burden depth or other reasons. Also used above chutes. Available in AUTOMATIC SELF-CLEANING TYPE with cross belt which discharges iron to the side. Ask for Catalog 301-A.

NEW! PERMA-PLATE MAGNETS

Here's low cost, powerful, permanent magnetic protection. For installation above or in chutes and above belts. Ideal for stoker protection. Non-electric; magnetic permanence *guaranteed* for life of installation. Send for Bulletin B-1205A.

Dings MAGNETIC SEPARATION HIGH INTENSITY

DINGS MAGNETIC SEPARATOR CO.
4765 W. Electric Avenue
Milwaukee 14, Wis.

"Separation Headquarters Since 1899"

put enough charge in capacitor C_1 to hold a minus bias on the grid that will prevent tube E from closing the relay.

When the lights are about to be turned off automatically, daylight about equals that from the room lamps. Then double normal illumination will be reaching the phototube's cathode. At this illumination intensity the phototube is sufficiently conductive to discharge capacitor C_1 and reduce grid bias to where tube E passes enough current to operate the relay.

When the relay closes, it opens contacts K to put resistor R_3 in series with coil M, and contact K_1 short circuits this coil so contact K_2 opens to turn off the lights. Now, the light intensity is only about one-half of what it was before the lights were turned off.

Normally phototube P would turn these lights on again. But this is prevented by contact K_2 closing to connect potentiometer P_1 into the grid rectification circuit. Potentiometer P_1 arm is set well over to the left to cut most of its resistor out of circuit. Then when contact K_2 closed it formed a low-resistance circuit for grid rectification, so capacitor C_1 is given only a small charge. Grid bias, therefore, remains low in spite of decreased conductivity of phototube P and the relay remains closed, in order to keep the lights turned off.

Daylight Decreases. As daylight decreases below normal room illumination, phototube P becomes less conductive and the charge in capacitor C_1 and minus bias on the grid increases. At about 80% of normal room illumination, grid bias is high enough to reduce the current through tube E to where the relay opens and turns on the room lights.

When this happens, illumination in the room almost doubles. Normally, the increased conductivity of phototube P would cause the lights to be turned off again. But contacts K_2 have opened and increased grid rectification voltage to where the grid is maintained sufficiently minus to prevent the relay closing. So the light-circuit contactor remains closed until daylight is again about equal to the illumination in the room.

The daylight intensity, at which the room lights will be turned on and off, can be regulated within limits by adjusting potentiometers P and P_1. Moving the arm on P to the right tends to hold the room lights on, whereas moving the arm on P_1 to left tends to hold them off.

In this and the previous article, we have considered electronic relays that closed and opened almost instantaneously. In the next article, we will study relays that are given a time delay in their operation.

Look to the NATION'S CAPITAL!

BELLEVIEW APARTMENTS, New Alexandria, Virginia

Architects
Mills & Petticord
Consulting Engineer
Andre Merle
Heating Contractor
James Plumbing and Heating Co., Inc.

Belleview Apartments Typify Scores of Centrally Heated Housing Projects Using RIC-WIL Insulated Piping

THE RECORD of postwar housing construction in the District of Columbia and its environs is an impressive one—particularly with respect to the many thousands of new rental apartments that have been made available.

An outstanding feature of these projects is the widespread use of Central Heating . . . providing "ready made heat in its most convenient form". . . making them as truly modern in this respect as they are in all others.

Equally significant is the fact that so many of these centrally heated projects use factory-prefabricated and pre-tested Ric-wiL Insulated Piping . . . additional evidence of the generally acknowledged superiority of this efficient method of insulating and protecting distribution piping.

● *For more information on Central Heating and Ric-wiL Insulated Piping, write for "Housing America," Form 4804, to: The Ric-wiL Company, Department 5L.*

Why it Pays to SPECIFY RIC-WIL *Insulated Piping*

- One order covers the complete piping system
- Definite costs accurately determined in advance
- Minimum interference with other work
- Lightest weight system ever developed
- Meets all labor requirements and construction conditions
- Easily and quickly installed with minimum field work
- Durability pre-tested and proved by 40 years of experience
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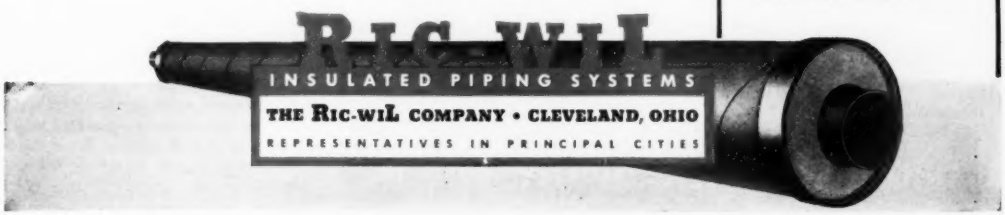
- Mechanical coupling or welded connections, as desired



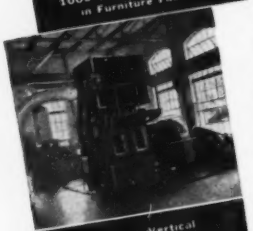
For Nearly Four Decades

SKINNER "UNIVERSAL UNAFLOW"

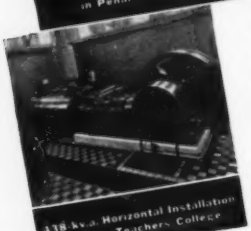
STEAM ENGINES

HAVE BEEN MEETING INDUSTRY'S DEMAND FOR DEPENDABLE, ECONOMICAL ELECTRIC POWER

1000-kv.a. Horizontal Unit in Furniture Factory

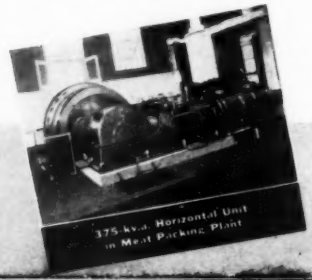


375-kv.a. Vertical in Penal Institution



438-kv.a. Horizontal Installation in State Teachers College

750-kv.a. Vertical in State Welfare Institution



375-kv.a. Horizontal Unit in Meat Packing Plant

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Maintained economy is guaranteed, and is due to patented design of the poppet inlet and auxiliary exhaust valves, which are steam-tight after long use and under any variation of steam pressure or temperature. Steam consumption guaranteed subject to test after six months' operation, with final payment withheld until after test.

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In general use for direct connection to electric generators, refrigeration equipment, compressors, blowers, pumps, etc. Special manual or automatic controls for variable speed and load requirements.

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For limited space, or where other conditions make a vertical engine preferable, the stationary "Universal Unaflow" is offered in multi-cylinder vertical type, embodying the same fundamental economy and design features as the horizontal. Multi-cylinder vertical "Universal Unaflow" assemblies also extensively used for variable-speed compressor drive.

For Over 80 Years, Doing One Thing Well - Building Steam Engines

SKINNER ENGINE COMPANY, ERIE, PA.

Technical Briefs

(Continued from page 128)

STEAM GENERATION

DESIGN OF INDUSTRIAL POWER PLANTS, *by Parker A Moe, of Gates, Moe, Weiss and Paperthein, consulting engineers.* All phases of industrial power-plant design cannot be covered in any one paper. But the author does treat many of the important points.

Operating labor and fuel costs have increased considerably in recent years. For these reasons, plus the need to pare manufacturing costs, the power plant is the object of close study.

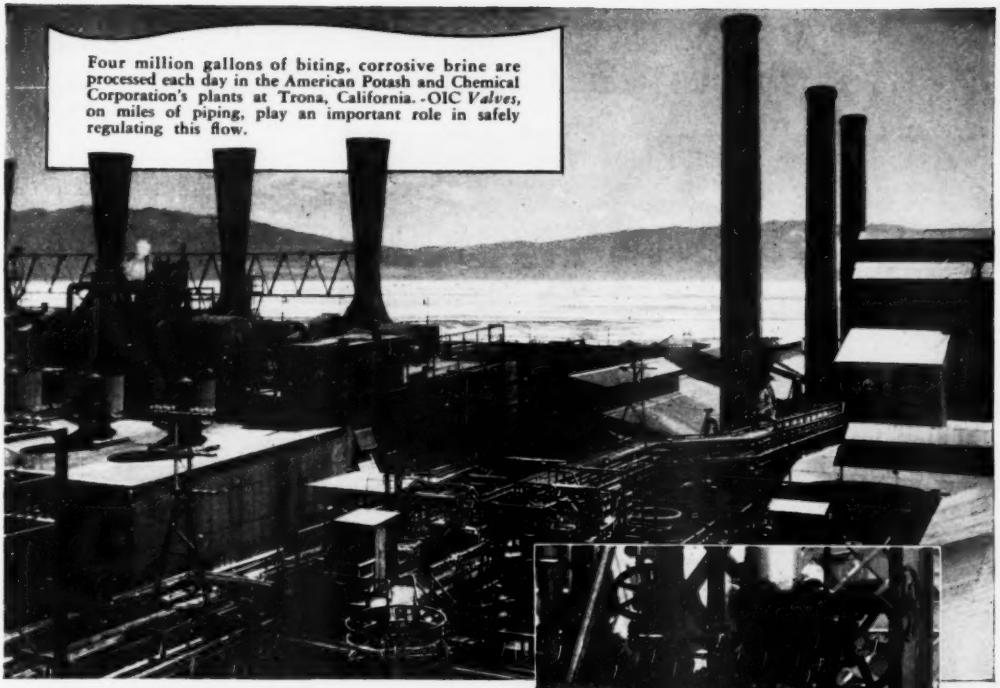
Today the engine room and the boiler room are combined without a separating wall to save building costs. Better heat balance, labor-saving methods and fewer expected outages reduce power-plant operating costs. Where coal is used automatic coal and ash-handling systems now find favor. In some sizes boilers, turbines and even soot blowers operate automatically to cut down on labor expenses.

Today's industrial plant is expected to use about 80% of the available heat energy released in the fuel. Compared to the utilities thermal efficiency figure of 40% tops, this seems fantastic. But it is true. The most efficient power-generating cycle discards in heat to the condenser cooling-water cycle about 60% of the heat released from the fuel.

The industrial plant, on the other hand, takes exhaust steam from its power-generating turbines and applies it to process. The process is properly charged for the heat it receives. With such a practice the power generation phase of the power plant becomes a by-product of the industrial. *MWP Paper.*

RECENT DEVELOPMENTS IN STEAM GENERATION, *by Frank X Gilg, Babcock & Wilcox Co.* Use of higher steam pressures and temperatures has resulted in a steady reduction of station heat rates for kwhr produced. Natural circulation boilers are in service with pressures as high as 2500 psi. Possible future improvement in heat rates lies in the direction of higher steam temperatures and this means better alloys than are now available. Now under way are a number of research programs, one of which is being run by the author's company.

Next, the paper reviews available controls of final superheat temperature by (1) an attemperator (2) bypassing gas around the superheater (3) use of high-pressure water sprays (4) recirculating gas from economizer outlet back into the furnace at lower loads (5) reducing heat absorption through adjustment of the combustion zone. Selected method depends on size, pres-



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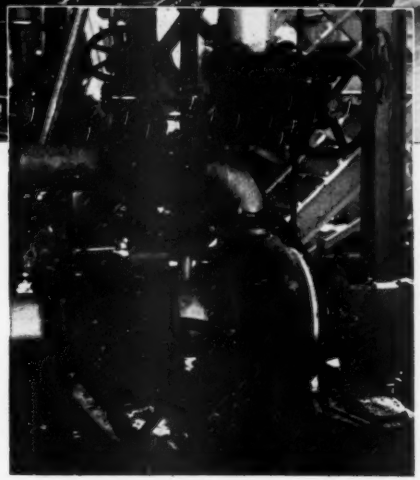

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sure and temperature of the unit and the range of load.

The practice of reheating to improve station heat rates is covered.

The author discusses the experiences to date of the cyclone furnace. He describes its operation and traces some of its development. He reports several central station units are being built to operate without induced-draft fans. *MWP Paper.*

MAINTENANCE OF PACKAGED BOILERS, *by F W Haines, Cleaver-Brooks Co.* The packaged boiler represents a modern and efficient tool for industry. But many small plant owners seem to feel the boiler plant can be regarded in the same terms as automatic domestic-heating installations. Such an attitude is in strong contradiction to long accepted rules of operation that govern larger plants. Indifference will never give reliable operation, continued high efficiency and safety.

Perhaps 75% of service problems on packaged boilers have to do with fuel-burning equipment and its control. Next in frequency are those of water treatment. If reasonable attention is given to feedwater heating, water treatment and blowdown there should be fewer difficulties from reduced boiler-equipment life. Chief solution is for the plant owner to require a better water-treatment service than is generally available to the average small-plant owner today.

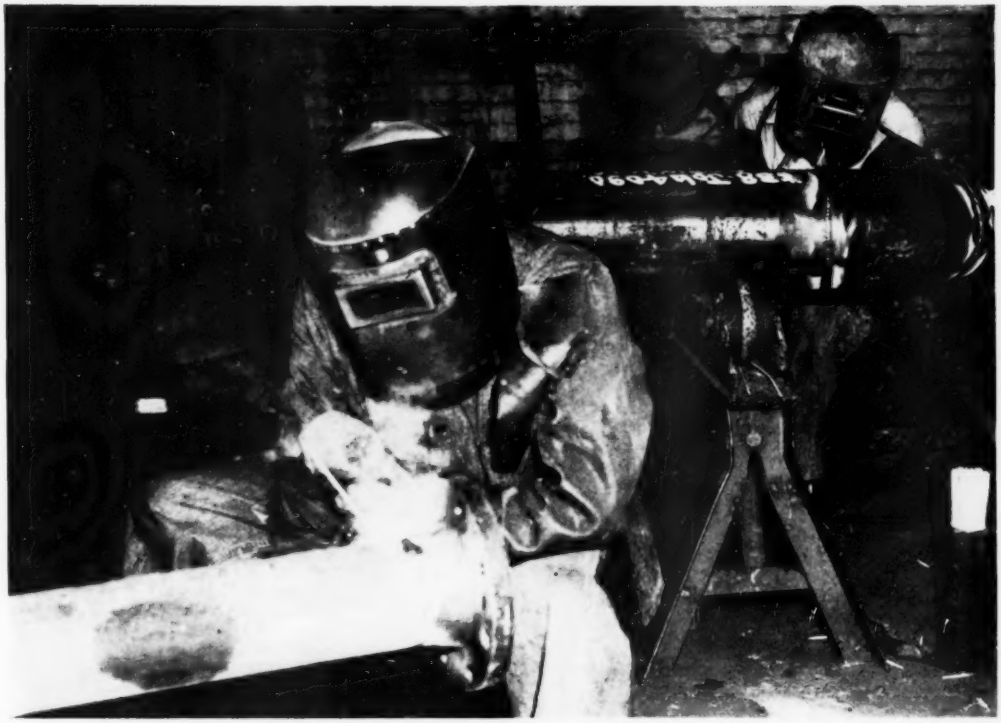
When comparing costs of the packaged boiler against other forms of steam generation the author suggests the use of a 24-hr efficiency. He claims such a figure would prevent a true picture since it would include low-load efficiencies, plus banking and starting-up losses. *MWP Paper.*

PREVENTIVE MAINTENANCE PROGRAM FOR SMALL PLANTS, *by Leland J Mamer, Evanston Hospital Assn.* First what do you mean by preventive maintenance? The author feels it is setting up a maintenance schedule for every piece of equipment in the plant. Breakdowns with this system are held to a minimum.

In setting up a maintenance schedule make use of an ordinary journal book. List in it boilers, stokers, automatic controls and meters, pumps, heaters, water softeners, engines, traps and so on. Along side of each put down size, type and other pertinent data.

Make a separate set of records for each piece of equipment and carry on it all repairs. Such records give you a quick check on how many and how involved the repairs have been.

After a little experience on repairs you can time the next needed one and thereby schedule an outage for preventive maintenance. What's more you can space your periodic checks to keep a



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close eye on potential trouble-makers and yet be certain to check your better service equipment.

After you have trained your personnel to be maintenance-conscious you may elect to classify pieces of equipment by function. In other words, all boilers and boiler auxiliaries go under one heading, all pumps and accessories likewise go under a single listing, and so on. Such a system enables you to give maintenance cost figures for the major elements in your power plant. *MWP Paper.*

Engineer's Bookshelf

(Continued from page 124)

defined. Many basic concepts such as fusion, penetration, bond, bead weld, etc are defined and distinctions noted.

The accompanying master chart lists all 37 welding processes in use today. The chart compares these processes on the basis of similarities and differences to 24 fundamental characteristics important in production welding.

ARCTIC AND HUDSON BAY DRAINAGE (1949). *462 pp, 440 tables, $1. Controller of the Dominion Water & Power Bureau, Department of Mines & Resources, Ottawa, Ont. Canada.*

This is Vol 97 of the *Water Resources Papers,* which deal with the surface-waters supply of Canada. It contains the results of investigations by the Dominion Hydrometric Survey in Alberta, Saskatchewan, the Northwest Territories and part of British Columbia and Ontario, for the climatic year, Oct 1943 to Sept 1944. The report contains a short explanation of the organization and scope of the work. Then follow 440 tables of stream-flow data for rivers and streams within the area mentioned, together with meteorological data including evaporation.

MATHEMATICS FOR ELECTRICIANS. *By Martin H Kuehn, Principal of Technical High School, Buffalo, N.Y. 372 pp. 8¼x6 in. McGraw-Hill Book Co, 330 W 42 St, New York 18, N.Y.*

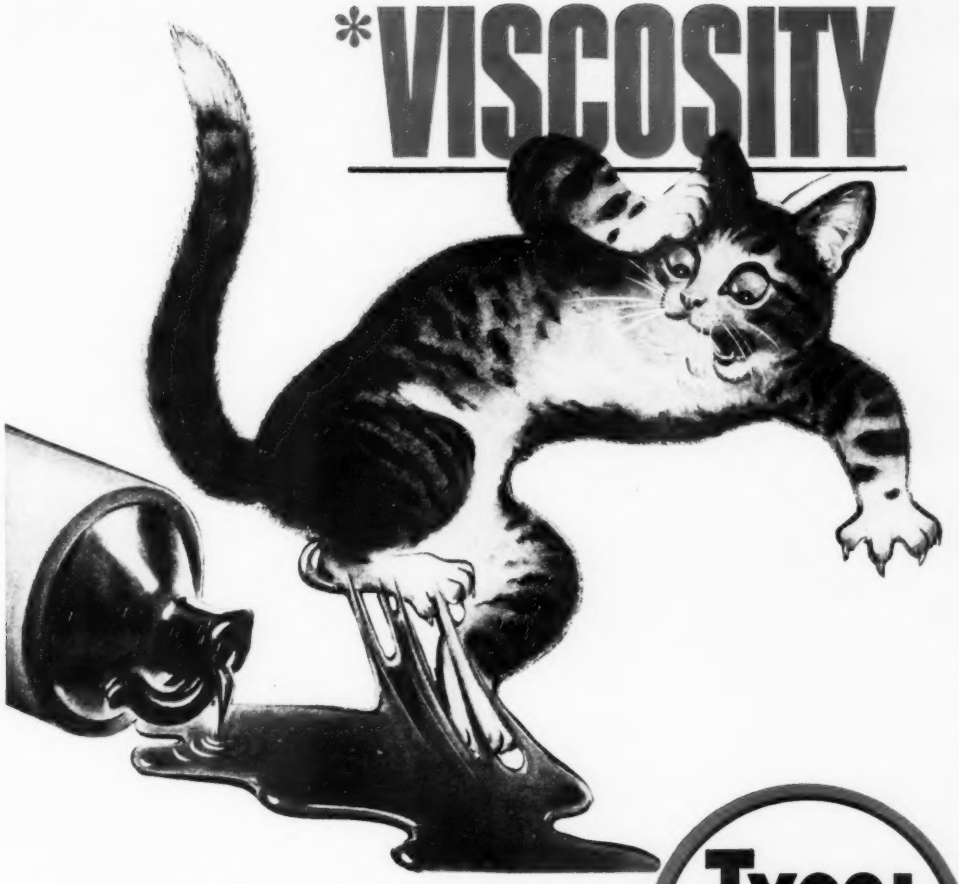
Using simple, everyday language, this practical book is designed to make mathematics easy for the electrician. The reader is taken, in easy stages, from simple arithmetic and algebra through the slide rule and graphs, to calculations in alternating-current and vector problems.

Each chapter carries a series of problems, with answers at end of book. Since it includes about all the math needed to handle practical problems in the field, the book is of value to trade student and electrician alike.

ELEMENTS OF DIESEL ENGINEERING (*2nd edition,* 1949), *by Orville L Adams, Lt Commdr, USNR. 367 pp; 5½x8; tables, illust, $5. Norman W Henley Publishing Co, 254 W 54th St, New York, N.Y.*

During the war, the first edition of this text on diesels went out of print. Embark-

*VISCOSITY



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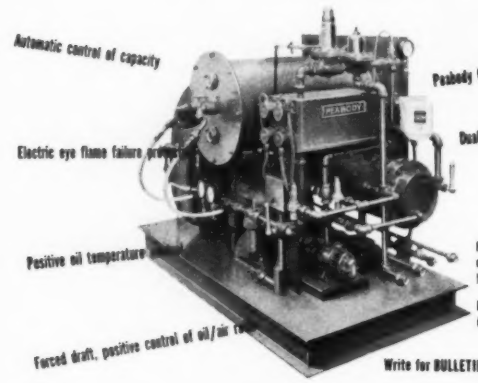
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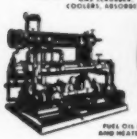

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ing on a complete revision immediately after the war, the author found it necessary to scrap nearly 90% of the old material and write new to cover the many developments of the war years. Then as the book was being readied for the printer, Orville L Adams died suddenly while on temporary active duty.

The new edition, like the first, is designed for use as a textbook for classroom use, but the material is so presented that the apprentice or operator can understand it without benefit of instruction. Questions, answers and problems are included. Subjects covered are: Diesel definitions, diesel mathematics, engine cycles, injection, combustion, rating, testing and performance, air intake and super-charging, indicator diagrams, fuel and lubricating oils.

WELDING METALLURGY, IRON AND STEEL, *by O H Henry, professor of metallurgical engineering, Polytechnic Institute of Brooklyn and G E Claussen, metallurgist, Reid-Avery Co. Revised by G E Linnert, senior research engineer, Armco Steel Corp.* 505 *pp,* 4⅝x7¾, *illust, tables, cloth,* $2.50. *American Welding Society,* 33 *W* 49*th St, New York, N.Y.*

Present revision involves extensive rearrangement of Henry and Claussen's original publication. First edition contained two volumes prepared from material presented during fundamental and advanced lecture courses on metallurgy and metallography in the years 1938 and 1939 at Polytechnic Institute of Brooklyn under the joint auspices of the Institute and the New York Section of the American Welding Society. These two volumes have been consolidated in this rearrangement.

The information garnered on welding materials over the years since 1938 and 1939 has been sifted and pertinent matter included as new. Steels or ferrous alloys are the center of most discussions. The Fahrenheit temperature scale is used because it is so prevalent in the U.S. An index has been added.

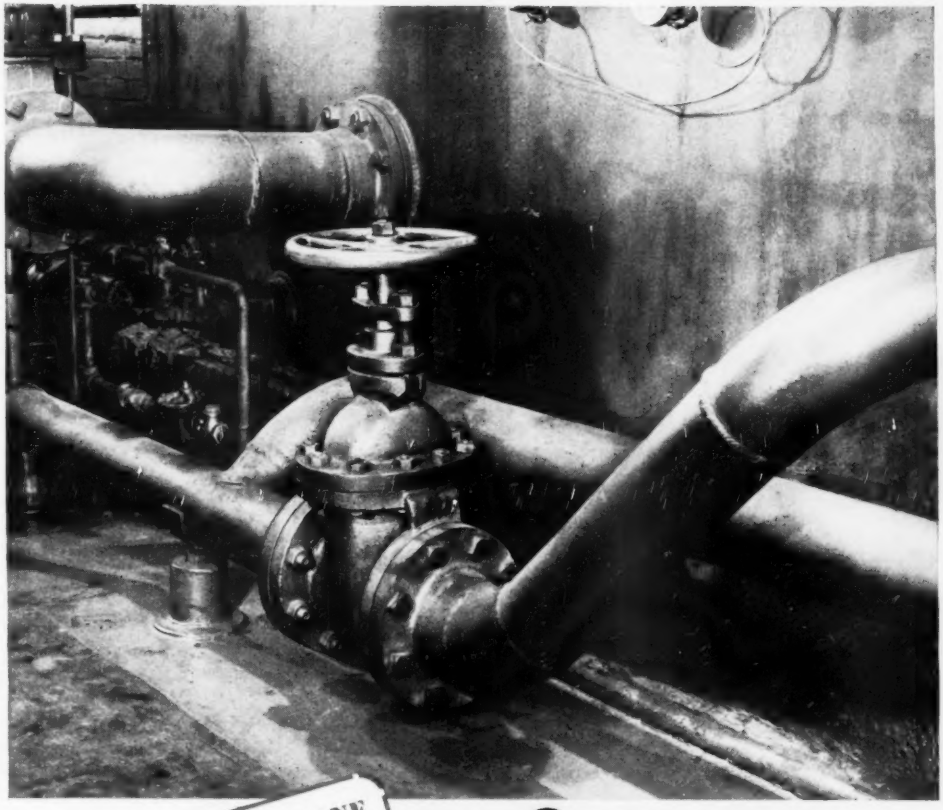
DIESEL ENGINES (*2nd edition,* 1949), *by J W Anderson, Consulting Engr, Brookfield Center, Conn.* 556 *pp;* 6x9; *tables, illust.* $7. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N.Y.*

Many will remember the first edition of Anderson's "Diesel Engines" as a well-rounded presentation of what the diesel is, what it does, and how to select and operate it. While design considerations are discussed, the emphasis throughout is on what the owner and operator need to know. The treatment is entirely practical.

After a brief presentation of history and theory, succeeding chapters cover design characteristics and details, descriptions of modern engines for various applications, scavenging, supercharging, combustion and fuel injection, controls, and the various auxiliary systems: cooling water, lube oil, fuel, starting. Concluding chapters discuss waste-heat recovery, installation, operation and maintenance, performance and cost of operation, aids to engine selection. The second edition has been completely revised and brought up to date.

SCAVENGING OF TWO-STROKE-CYCLE DIESEL ENGINES (1949), *by Paul H Schweitzer,*

How to cut corners that cost



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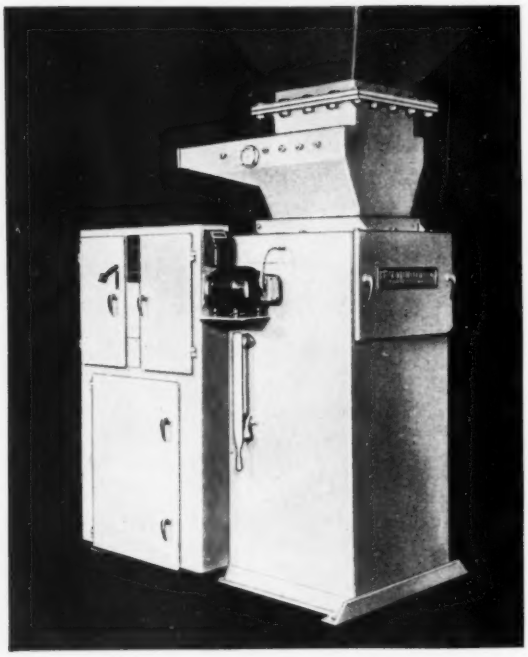

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Pennsylvania State College. 268 pp; 7¼x 10¼; *tables, illust.* $7.25. *The Macmillan Co, 60 5th Ave, New York, N. Y.*

Difference between 2-stroke and 4-stroke-cycle engines lies largely in the method of scavenging, yet little is available in English on this important subject. Thus this book fills a long-felt need.

After introductory chapters dealing with internal-combustion engines in general, the peculiarities of the 2-stroke engine, and terminology and definitions, the author tackles the effect of scavenging on mean effective pressure, scavenging arrangements, porting, supercharge, and the intake and exhaust systems. Additional chapters deal with the Kadenacy system, high supercharging of 2-stroke engines, and experimental methods for investigating scavenging. A complete porting calculation is given.

While emphasis throughout is on design of scavenging systems, users of 2-stroke engines who are interested in a better understanding of scavenging should find the book useful. Material is handled without higher mathematics, except in appendices, and in a clear and straightforward manner. In many cases, complicated formulas are reduced to chart form for convenience.

POWER CAPACITORS. *By R E Marbury, Westinghouse Electric Corp.* 205 *pp.* 9¼x6⅜. *$3.50. McGraw-Hill Book Co. 330 West 42 St, New York 18, N.Y.*

After covering the fundamental working principles of capacitors and materials used in their manufacture, the author moves on to include characteristics of the completed units, basis of power-capacitor ratings and operating limitations. Types of capacitors commonly manufactured and their fields of application are included.

Discussed are selection and uses of fuses and breakers employed with capacitor units, and merits of different means of switching capacitor banks. The author does not include all design details but rather application of capacitors, such as power systems use.

BASIC ELECTRICAL PRINCIPLES. *By Maurice G Suffern, Major, Ordnance Dept Army of the United States.* 430 *pp* 8½x6, *cloth,* $3.20. *McGraw-Hill Book Co, 330 West 42 St, New York 18, N.Y.*

This textbook is designed to aid in training electrical-trades students on a vocational-education level. The basic facts of electrical theory are expressed in simple terms, and so no previous knowledge of electricity or related subjects is required.

The book is divided into twelve chapters, each supplemented by well-drawn illustrations, as follows: Introduction to Electricity, Batteries, The Electric Circuit, Electromagnetism, Alternating Current, Inductance, Capacitance, Effects of Inductance and Capacitance, The Electric Generator, The Electric Motor Rectification of Ac, The Electric Meter.

Each chapter contains a series of multiple-choice questions, the answers listed in an appendix. Also included in appendix form are the subject of square root and a summary of formulas.

(Continued on page 162)

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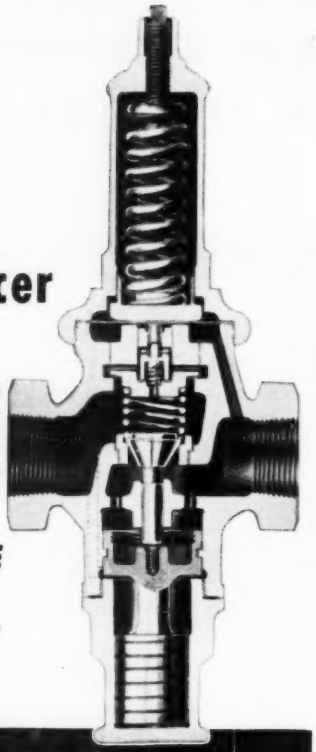

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Masoneilan No. 11 Reducing Valves give you better steam pressure regulation regardless of initial pressure fluctuations or changes in demand. Their accurate performance cuts operating expenses by reducing waste. The rugged construction assures long life and reduces maintenance expense. Initial pressure ranges up to 250 lbs. reduced to any desired pressure between 5 and 75 lbs. or 75 and 225 lbs. Sizes from ½" to 4".

COMPARE THESE EXTRA ADVANTAGES

- STAINLESS STEEL main valve, seat ring and auxiliary valve at *no extra cost*.
- WIDE RANGE OF ADJUSTMENT without change of spring.
- LARGE CAPACITY permits use of smaller size regulators.
- FULL THROTTLING RANGE permits accurate, fast response to demand changes.

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Sales Offices or Distributors in the Following Cities: New York • Syracuse • Chicago • St. Louis Philadelphia • Houston • Denver • Pittsburgh • Cleveland • Cincinnati • Tulsa • Atlanta Los Angeles • San Francisco • Salt Lake City • El Paso • Boise • Albuquerque Mason-Neilan Regulator Co., Ltd., Montreal and Toronto

INDUSTRIAL ELECTRICITY, *Vol 2—Alternating Currents. By William H Timbie, of Massachusetts Institute of Technology, and the late Frank G Willson, formerly with the Wentworth Institute, Boston, Mass. 781 pp, 8⅝x6. $5.95. John Wiley & Sons, Inc. 440 Fourth Ave, New York 16, N. Y.*

A study of ac theory and practice in which mathematics is limited to algebra and a few simple trigonometric equations. Each new concept is introduced to the student by stating what happens and then explaining exactly why it happens. The explanations are followed by practical examples worked out in detail with the aid of wiring diagrams and vectors.

The text covers the fundamental ideas, use of vectors, single and polyphase circuits, power and power factor, alternators, motors, transmission lines, converters and rectifiers.

Although the author took more pages of text than is usually devoted to the subject, the more thorough treatment will save time in the long run for both student and instructor.

DIE KREISELPUMPEN FUR FLUSSIGKEITEN UND GASE (*Centrifugal Pumps and Blowers*). *By Dr Ing C Pfleiderer, Professor at the Technischen Hochschule Braunschweig. Third edition, paper binding,* 517 *pp,* 353 *illust. Price* 51 *D M (about* $15). *Published by Springer-Verlag, Berlin, Germany.*

This very solid technical treatise, all in German, covers the field of centrifugal and axial-flow pumps and blowers. It will have great interest for an extremely limited number of American specialists and designers of these types of equipment.

Piping

ASTM SPECIFICATIONS FOR STEEL PIPING MATERIAL, *6th edition (Dec* 1948). *By ASTM Committee A-1 on Steel, Pipe, Tubes, Castings, Forgings, Bolting.* 319 *pp; tables, illust.* $3. *American Society for Testing Materials,* 1916 *Race St. Philadelphia* 3, *Pa.*

The 50 specifications in this book are in widespread use for all types of plants using piping and fittings. Among the piping specs are: welded and seamless, electric-fusion-welded steel pipe, welded alloyed open-hearth, iron pipe, seamless chromium-molybdenum alloy-steel pipe for service at high temperature and seamless and welded austenitic stainless steel pipe.

Under "Boiler, Superheater and Miscellaneous Tubes" are lap-welded and seamless boiler tubes, welded alloy-steel boiler and superheater tubes, copper-brazed steel tubing, seamless and welded austenitic stainless-steel tubing for general service.

Three specs cover refinery still tubes, another three refer to heat-exchanger and condenser tubes. There are five specs on: castings; mild- to medium-strength carbon-steel for general applications; carbon-steel for valves, flanges, etc, for high-temperature service. Other high-temperature service items covered are: alloy-steel for valves, flanges, etc; carbon-steel and alloy-steel for fusion welding.

"We had a real Problem on our hands
. . . how to get maximum productive energy from our fuel without uselessly heating excess air."
TRACY

"This remarkable Cities Service Heat Prover quickly solved our problem"

SCORES of large industrial plants have found this exclusive Cities Service Heat Prover Service a tremendous help in uncovering facts vital to efficient production such as:

1. How much energy is wasted in uselessly heating excess air?
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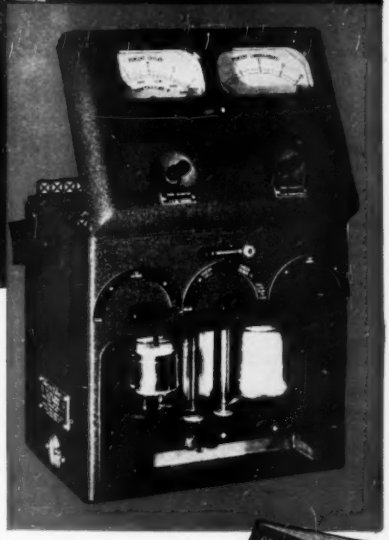


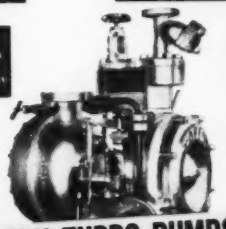
Free

A fact-filled booklet entitled "Combustion Control for Industry." Write Cities Service Oil Company, Sixty Wall Tower, Room 466, New York 5.

CITIES SERVICE

no other pump

has so much to offer . . .


No destructive casing erosion or corrosion
Exact hydraulic and mechanical balance, light weight rotor, large bearings; result: bearing troubles practically unknown
All parts made to gauge and replaceable without fitting; all parts in stock at factory with wearing parts available from agencies' stocks
High efficiency pump plus high speed two-bucket raw turbine results in minimum steam consumption
Proved for performance over a period of more than twenty years in service
Pump gland leakoff provides adequate recirculation; suction pressure only on packing
Loss of suction reduces speed without tripping; automatic speed recovery with suction restoration
Rigid one-piece steel casing plus heavy shaft plus ample clearances result in no damage from dry operation
Matched Pump, Turbine and Governor; under one responsibility
Compact; light in weight; quiet and low in maintenance
Wide range exact pressure governing
No interstage leakage

COFFIN TURBO PUMPS

compact . . . noiseless . . . vibrationless

10,000 hours continuous operation between inspections!

LEADING engineers in industry today look for better and more efficient equipment to cut costs AND boost production efficiency. That's why Coffin Turbo Pumps are being specified on an increasing number of jobs — *they deliver more dependable performance than any other comparable pump on the market.* Backed by more than 20 years experience, Coffin Pump specifications have been proved time after time on hundreds of installations. Check these specifications in your files the next time you want *real* pump performance — steam pressures to 850 psi . . back pressures to 200 psi . . pump capacities to 500 gpm . . . discharge pressures to 1100 psi . . heads to 2400 feet . . liquid temperatures to 300°F . . .

Complete description of Coffin Turbo Pumps are available on request or in the ASME Catalog or Sweet's File.

Specific proposals and application suggestions are available without obligation on receipt of operating data.

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The J. S. COFFIN, JR., COMPANY

326 SOUTH DEAN STREET, ENGLEWOOD, NEW JERSEY

METALLURGY AND PIPING 1948. *A report of the Metallurgy and Piping Subcommittee of the Prime Movers Committee, EEI.* 63 *pp;* 8½x11; *paper;* 24 *illust.* 60c *to members,* $1.50 *to nonmembers. Edison Electric Institute,* 420 *Lexington Ave, New York, N. Y.*

A brief outline of some activities of organizations interested in piping materials. In view of the large amount of research in progress this report attempts to keep interested parties informed.

In the field of high-temperature piping, one statement gives additional data on creep measurements, another important details on welding proecdures and piping materials for steam-electric stations operating at 1000 F and 1050 F.

Five statements cover the problem of graphitization of old-specification pipe with high-aluminum content. Trouble developed early in 1948 with corrosion of stems in small valves. Solutions developed should be of value to companies having valves in stock.

Oxyacetylene Welding

OXYACETYLENE WELDING AND CUTTING, *4th edition (1949). By S Plumley, formerly chief engineer, Smith Welding Equipment Corp, revised by T B Jefferson, editor "The Welding Engineer."* 356 *pp;* 8½x11; *illust, tables.* $6.50. *McGraw-Hill Book Co,* 330 *W* 42*nd St, New York* 18, *N. Y.*

The subject matter has been rearranged to give better continuity in the treatment of the material, for both classroom and home-study use. Fundamentals of oxyacetylene welding and the equipment are covered in the early chapters. The bulk of the book discusses simple welding techniques, flame cutting, bronze welding and brazing, the welding of various alloys, hard facing, and hints on job-shop operation and management. Particular stress has been placed on pipe welding and the newer techniques in the welding of alloy steels, aluminum, magnesium, silver brazing and hard facing.

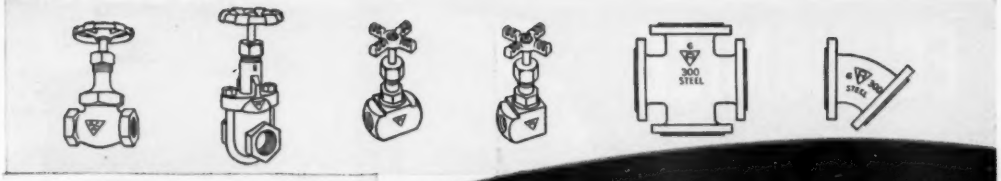
Engineering Economics

ENGINEERING ECONOMICS AND PRACTICE (1949). *By M J Steinberg and W Glendinning.* 102 *pp;* 8½x11; *illust; paper.* $3. *W Glendinning,* 5123 *Bell Blvd, Bayside, N. Y.*

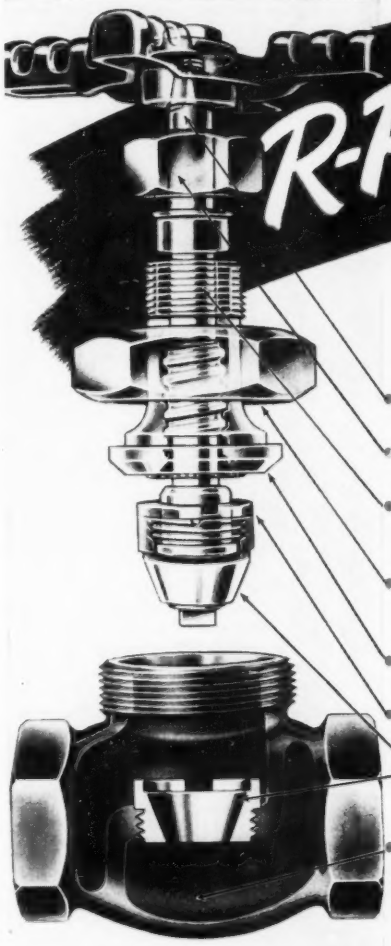
This book gives a summary of accepted theory and practice of engineering economics. It is designed to assist engineers in preparing for examinations to qualify as licensed professional engineers, to aid student engineers in their studies of the subject and serve as a handy reference for practicing engineers.

A brief but comprehensive review of the field is included, compound interest formulas, depreciation, comparison of alternate proposals, calculating a prospective rate of return, replacements, costs and interest tables.

Problems in the book have been taken from past examinations in Professional Engineering—Part III, Engineering Economics and Practice—given by the New York State Board of Examiners.



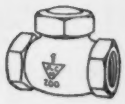
R-P & C HEAVY-DUTY BRONZE GLOBE VALVE

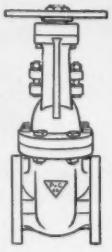


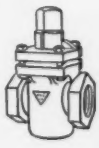
FOR TOUGH THROTTLING CONDITIONS

500 BRINELL DISC AND SEAT

- **STEM** high tensile rolled bronze. Large diameter and long thread contact.
- **PACKING NUT** and gland follower of heavy bronze transmit even pressure onto packing.
- **STUFFING BOX** large and deep. Packed with formed rings of braided asbestos, lubricated and graphited. Can be repacked under pressure.
- **UNION NUT** heavy, rugged. Facilitates removal and replacement without danger of distorting body or threads.
- **BEVELED JOINT** permits tighter union between body and bonnet.
- **DISC LOCK-NUT** holds disc securely to end of stem.
- **FULL-PLUG DISC and SEAT RING** stainless steel of 500 Brinell—near diamond—hardness.
- **BODY** P & C High Test Bronze. Reinforcing ribs give added strength. Heavy end hexes with standard, full length threads.







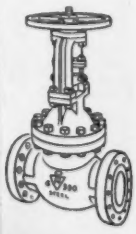


Fig. 531-P
350 lbs. Steam • 1000 lbs. OWG

Send **FOR THIS FOLDER** *which contains a detailed description of this valve. Ask for* **DH-116**

ACCO

Reading, Pa. • Atlanta • Baltimore • Boston • Chicago • Denver • Detroit • Houston
New York • Philadelphia • Pittsburgh • San Francisco • Bridgeport, Conn.

TRADE MARK

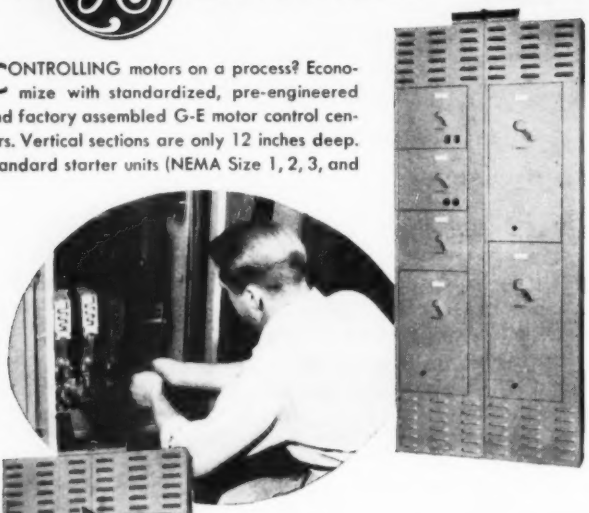
R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

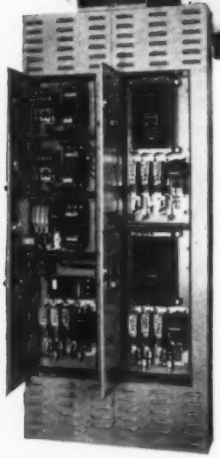
READING-PRATT & CADY VALVES

ECONOMIZE as you MODERNIZE

... Motor Control Centers

CONTROLLING motors on a process? Economize with standardized, pre-engineered and factory assembled G-E motor control centers. Vertical sections are only 12 inches deep. Standard starter units (NEMA Size 1, 2, 3, and 4 for 1 to 100 hp motors, 440 volts and below) are completely metal enclosed, have short-circuit and overload protection.





Save on wiring costs. Connections to incoming power from vertical bus bars are made in one quick shove by means of "clothespin contact", a special device on the back of each starter unit. Four screws hold unit in place. Wiring troughs are five inches wide, easily reached when cover plates are removed. Terminals are at top or bottom as you prefer. Everything front connected for flexibility of arrangement. Write for more details on these low-cost G-E motor control centers—Bulletin GEA-4979—at the nearest G-E office. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

Plant Problems

(Continued from page 122)

if load regrouping is necessary. After rearrangement of load, installation of differential relays will provide needed protection against winding faults.

TYLER G HICKS *New York, N. Y.*

Keep Unbalance Below 5%

AE IS TAKING A CHANCE on damaging his generator by running it unbalanced over long periods. This unbalance causes surface currents to flow in the rotor, resulting in greatly increased heating at the joint between the retaining rings and rotor.

Within the last year or two one of the insurance companies published pictures of a generator that was totally wrecked from this very cause. *AE* should take immediate steps to reduce this phase unbalance to as near zero as possible, and certainly not in excess of 5%.

J C PORTER *Rock Hill, S. C.*

Use Split-Core Ammeter

DAMAGE IS NOT LIABLE to occur to *AE's* machine because of unbalance but rather because two phases are overloaded. The 500-amp load on two phases may cause heating and eventually failure of the insulation. It is likely that the generator will carry 500 amp at a rating of 451 amp per terminal, but it is certainly not good practice as a steady diet.

Plant load can be shifted around to bring phases more nearly in balance; a little work with a split-core ammeter should indicate where changes can be made to load up the 300-amp terminal and reduce load on others. It will never be possible to make them all the same and keep them there as the load changes unless it is entirely 3-phase. But it should be possible to improve the balance greatly.

E A ROBERTS *Carlsbad, N. M.*

Phases Are Overloaded

SAFE LOADING of a 3-phase generator is limited by temperature rise in its windings. This is caused primarily by heating effect of the current it is carrying. Rated capacity of a 3-phase generator can be utilized safely only when current in the three phases is reasonably well balanced. With unbalanced load currents the temperature rise in the heavily loaded phase windings will be greater than in the windings carrying the smaller currents. Safe temperature rise is determined by the heavily loaded windings and not by average temperature rise in all windings.

Load current unbalance in *AE's* machine is considerable—about 11% of nameplate current rating in two generator leads. Whether the generator

7 BIG FEATURES *including Leakproof Seal*

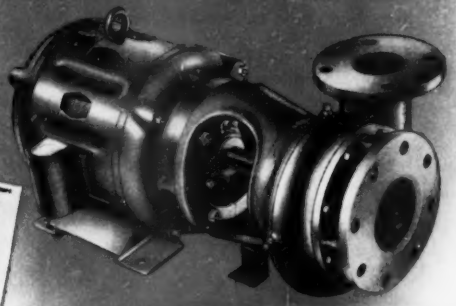
Engineers and maintenance men are astonished at the performance of the B & G Series 1522 Pump . . . because this unit really licks the pumping jobs which usually cause trouble.

A Mechanical Seal, instead of a stuffing box, is one of the reasons the 1522 gives such long, trouble-free service . . . especially where the pumped liquid contains foreign matter which is damaging to the ordinary stuffing box. The Seal is self-lubricating and eliminates the customary leakage through the packing gland.

Removal of a few bolts permits separation into three parts — motor, bearing bracket subassembly and pump body. The motors used are standard units, with replacements readily obtainable from motor manufacturers' stocks.

B & G Series 1522 Pumps are available as all-iron, bronze-fitted or all-bronze units.

1. Standard Motors
2. Mechanical Seal
3. Spring-type Flexible Coupling
4. Easy to Service
5. Interchangeable Parts
6. Compact Design
7. Competitive Price



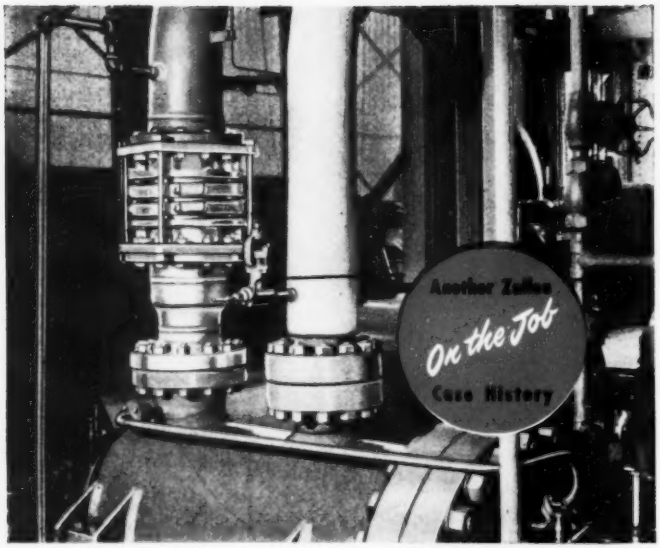
B & G SERIES 1531 CENTRIFUGAL PUMPS
This enclosed impeller, close-coupled pump is now available with leakproof Mechanical Seal. All units are laboratory-tested for capacity conditions required.

Complete engineering information is given in these two catalogs . . send today for your copies.

Hydro-Flo CENTRIFUGAL PUMPS

BELL & GOSSETT CO. • Dept. BC-36, Morton Grove, Illinois

*REG. U. S. PAT. OFF.



Another Zallea Repeat

WHEN West Penn Power Company added No. 7 Unit to its Springdale, Pa. Station in 1945, Zallea Stainless Steel Expansion Joints were installed to provide for expansion of the piping. Three years later, West Penn *again* selected Zallea Joints for use in its new Mitchell Station at Courtney, Pa. And, a second unit at Mitchell, now under construction, is *also* being equipped with Zallea Stainless Steel Expansion Joints.

Here, as in hundreds of cases, satisfied repeat customers continue to specify Zallea when they want the utmost in economy, dependability and long service life. *There's no packing to deteriorate . . . no maintenance required.*

There's a Zallea Expansion Joint for almost every requirement. Available in diameters from 3″ to 72″ for temperatures from sub-zero to 1600°F . . . for pressures from vacuum to 300 psi in standard designs and up to 1000 psi in special designs.

Catalog 47 contains complete information on all Zallea Expansion Joints. We would be pleased to send you a copy. *Write today.* ZALLEA BROTHERS, 814 Locust Street, Wilmington 99, Delaware.

Zallea
EXPANSION JOINTS

WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS EXCLUSIVELY

will safely take this over-current in two leads while carrying about 66% rated current in the third leg depends on how liberally the generator is rated. The unbalanced current appears to be in, or very near, the danger range. This is so not particularly because of the mere percentage of unbalance but because the rated current capacity is being exceeded in two of the three generator loads. Since this condition is frequently of long duration it should be corrected quickly.

Shifting a portion of the load to the lightly loaded phases is *AE's* best bet. Correcting the unbalanced condition, even though it might involve considerable rearrangement of the distribution system would be preferable to using relays to trip the machine off the line in event of 10 or 15% current unbalance.

J H BENDER *Tucumcari, N. M.*

Check Breaker Contacts

I BELIEVE *AE* has cause for concern. In our plant we find lighting, small single-phase ac motors and the like have in the past been tied in without balancing the load between phases. Because they are small these single phase loads did not cause much unbalance in our case, but *AE* may be up against a heavy single-phase unbalanced load.

There may be other reasons for unbalance besides single-phase loading. One possibility is poor circuit-breaker contact in the unbalanced phase. This could be quickly spotted by checking for overheating. I am in accord with the Operating Engineer in this matter because I feel an unbalance in excess of 10 to 15% can prove dangerous.

C N CARSON JR *Tyrone, Pa.*

National Assn of Corrosion Engineers is sponsoring a "Short Course on Corrosion," scheduled Sept 12-16 at University of Texas, Austin. The course is directed principally to persons in industry, who must deal with corrosion problems, but who have not had the experience or background to do so efficiently. Dr Norman Hackerman, of the university faculty, is assisting officers of the NACE south central region in making arrangements for the course. Dr Hackerman says the course will be useful as a refresher in the fundamental phenomena with which the corrosion of metals is concerned. Applications for official registration blanks are being received by A B Campbell, executive secretary, National Assn of Corrosion Engineers, 905 Southern Standard Bldg, Houston 2, Texas. Registration fee is $20.

Bechtel Corp, San Francisco, has been retained by Utah Light and Power Co to engineer and supervise construction of a new 60,000-kw steam electric generating unit, first of an eventual 3-unit station, in Salt Lake City. Completion is scheduled for 1951.

AVOID THE LUXURY TAX
on Idle Horsepower

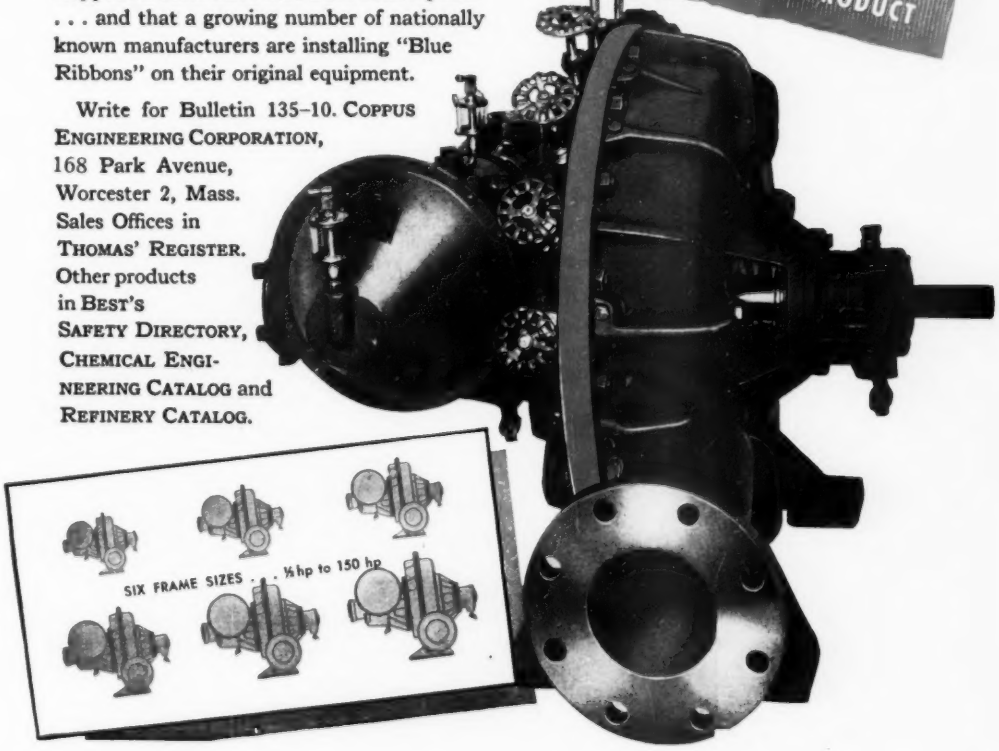
When your horsepower needs are small, why pay the extra cost of larger turbines, designed for much more power than you require?

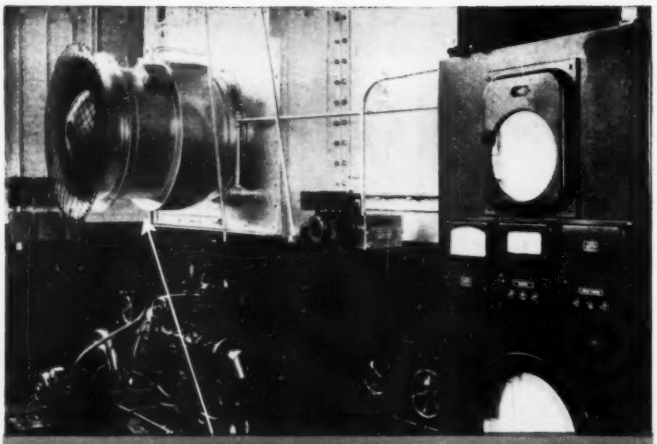
You pay only for the horsepower you need when you fit the right Coppus "Blue Ribbon" Turbine to the load. They're made in six frame sizes . . . from 150 hp down to fractional . . . priced in proportion to their size.

That's why you'll see more and more Coppus turbines powering pumps, blowers, fans, stokers and other equipment requiring a steady source of small hp. ***Steady*** is the word for these busy little turbines. Like all Coppus "Blue Ribbon" products (blowers, ventilators, gas burners, etc.) each Coppus turbine is precision-made, with close tolerances checked by Johansson size blocks. And before shipment, the turbine you get is dynamometer-tested.

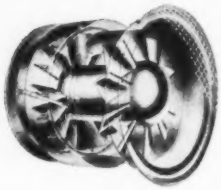
No wonder more than 85% of all orders for Coppus turbines since 1937 have been repeats . . . and that a growing number of nationally known manufacturers are installing "Blue Ribbons" on their original equipment.

Write for Bulletin 135–10. COPPUS ENGINEERING CORPORATION, 168 Park Avenue, Worcester 2, Mass. Sales Offices in THOMAS' REGISTER. Other products in BEST'S SAFETY DIRECTORY, CHEMICAL ENGINEERING CATALOG and REFINERY CATALOG.





The Wing Blower is "working out to the fullest satisfaction of everyone"



Wing EMD Blower showing simple design and built-in volume control. Internal radial dampers are actuated by an external balanced lever. Can be adjusted manually or by combustion controls.

That comment "to the fullest satisfaction of everyone," quoted from a recent letter, is characteristic of Wing Blower installations. For these Axial Flow Blowers are *built* to give satisfactory performance . . . simple and rugged construction, compact design with built-in capacity regulating dampers, combining high efficiency with quiet performance. Installation costs, too, are low. Write for descriptive bulletin or specific details.

L. J. Wing Mfg. Co. 50 Seventh Ave., New York 11, N. Y.
Factories: Newark, N. J. and Montreal, Canada

Wing

AXIAL FLOW BLOWERS

NEW EQUIPMENT

(Continued from page 146)

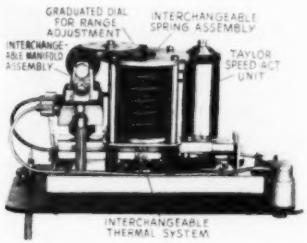
trolled throughout the charge at prescribed rates.

Equipment shuts down in power failure and charging resumes when power is restored. The charger shuts down completely when battery is fully charged. Type *S* is made in 16 ratings to service the most popular sizes of lead and Edison batteries. **Electric Products Co, Cleveland 12, Ohio.**

P816 • SIGNAL SYSTEM—Multiple signal and alarm system has many applications, including process work and in power plants.

Under abnormal conditions, two signal lights on the *Panalarm* go on and a warning is given by a horn or other sound device. The horn is turned off and white light goes off when failure is acknowledged by operator. The horn is immediately back in service for monitoring any further failures.

Unit may be actuated by any remote switch, thermostat, float switch, etc. Many combinations of light signals are available to indicate the trouble line; also to indicate when corrective measures have been taken.
Panalarm Products, Inc, 7216 N Clark St, Chicago 26, Ill.



P737 • TEMPERATURE TRANSMITTER—*Transaire* with *Speed-Act* is designed for applications where it is desirable to have the indication, record or control remotely located from point of measurement. Instrument is suitable where it is necessary to have high speed of response, small thermal elements and short-range spans within the limits of −375 F and +1000 F.

Incorporation of *Speed-Act* applies principle of pre-act or derivative action directly to temperature determination. *Speed-Act* overcomes the lag inherently present in response of any form of thermal

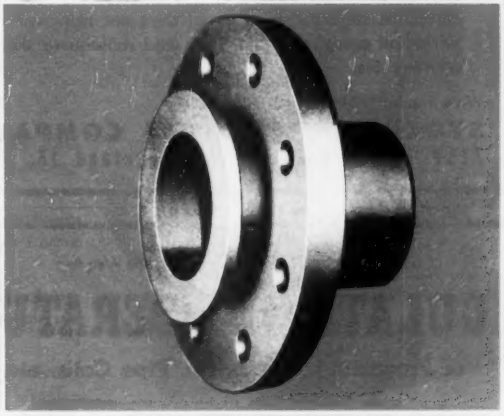
MIDWEST WELDING FITTINGS
Improve Piping Designs and Reduce Costs

IN WELDED PIPING SYSTEMS

SAVE TIME and MONEY on EQUIPMENT CONNECTIONS

by using MIDWEST

LAP JOINT STUB ENDS



Substantial savings of time and money result if Midwest Lap Joint Stub Ends are used when making connections to valves, equipment or other flanged outlets in welded piping systems. They have important advantages over flanges welded to the pipe.

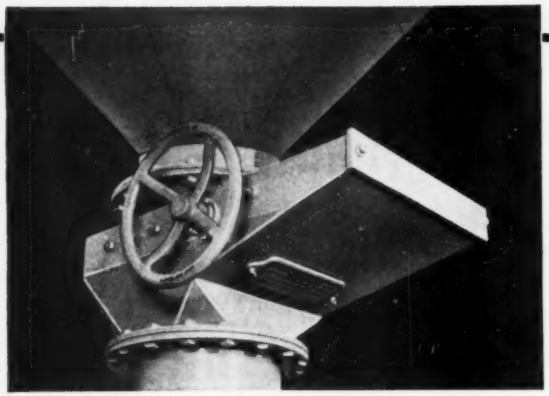
The swivel flange makes it unnecessary to line up the bolt holes before welding. Setting up is quick and simple because no special clamps or jigs are required to hold the face of the flange absolutely perpendicular to the axis of the pipe. Field crews report as high as 25% saving in erection time for making up a joint using Midwest Lap Joint Stub Ends in comparison with rigidly fixed flanges.

Midwest Welding Fittings improve piping—save money. Get in touch with the distributor near you.

3719

MIDWEST PIPING & SUPPLY COMPANY, Inc.

Main Offices: 1450 South Second Street, St. Louis (4), Mo.
***Sales Offices:* New York (7), 30 Church St.**
Chicago (3), 79 West Monroe St. • Los Angeles (33), 520 Anderson St. • Houston (2), 229 Shell Bldg. • Tulsa (3), 533 Mayo Bldg. • South Boston (27), 426 First St. • Distributors in Principal Cities.



S-E-CO. COAL VALVES are equipped with U-shaped gates. This construction assures easy operation of the valves because operating racks, pinions, and supporting rollers are in a space at the side, and, therefore, moisture in the coal does not run over these parts and cause rapid corrosion and subsequent sticking of the valve.

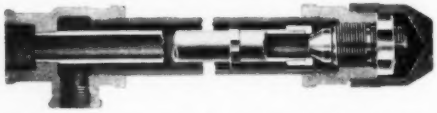
Write for bulletin.

STOCK ENGINEERING COMPANY
715P Hanna Building ★ Cleveland 15, Ohio

Use Nicholson Expansion Steam Traps Also to

REGULATE TEMPERATURE

of Processing Equipment, Pipe Coils, etc.



In addition to their long-proved effectiveness as a freezeproof, quiet, automatic means of drainage, Nicholson expansion steam traps are increasingly serving as a low-cost, efficient temperature regulator for processing and heating equipment. Write for installation information.

For Any Pressure from 0 to 250 lbs. Without Change of Valve or Seat

The valve can be easily adjusted to pass condensate at any temperature below 212° F., and thus regulate the temperature of equipment drained. Other features: easily installed; discharge air as efficiently as water; no air-binding; hardened stainless steel valve, seat. Lengths, 18" to 40". Pressures, 0 to 250 lbs., without change of valve or seat.

FOR ALL EQUIPMENT
Using Steam or Hot Water

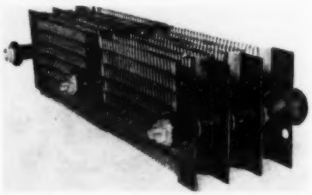
Radiators
Separators
Paper Machinery
Pipe Coils
Kettles
Railway Coaches
Dry Kilns
Vulcanizers
Switch Heaters
Laundries
Plastic Molding Presses

Catalog 448 or see Sweet's

W. H. NICHOLSON & CO., 125 Oregon St., Wilkes-Barre, Pa.

measuring element. Using pneumatic transmission, the instrument employs the forced balance principle, with an output in psi proportional to temperature of its thermal element. Pressure change can be transmitted 1000 feet or over.

Taylor Instrument Companies, Rochester 1, N. Y.



P810 • HIGH-CURRENT RESISTOR—Suitable for meeting special requirements for lightness, compactness and reliability, *Multipath* resistor uses a lightweight mesh-type construction. Mesh is so proportioned and formed that it is always self-supporting and never shielded by insulators.

Resistors are suitable for traction service, radiant heating at "black" temperature, forced-draft heating, and where installations are subject to heavy mechanical shock.

Exmit Electrical Corp, 59 Park Ave, New York, N. Y.

P751 • NAMEPLATE MACHINE—Bench style, pneumatic marking machine, Mathews 222, gives neat, attractive nameplate panels at production-line frequency.

Type changes can be quickly made. A handy type box in front of the operator allows replacement of "T-face" steel type in a type chase. Nameplates are placed in the nest, face down over type. Push the chase under head of the machine in correct position for marking. A hand- or foot-control valve connects to an air cylinder and air pressure moves pressure roll under type.

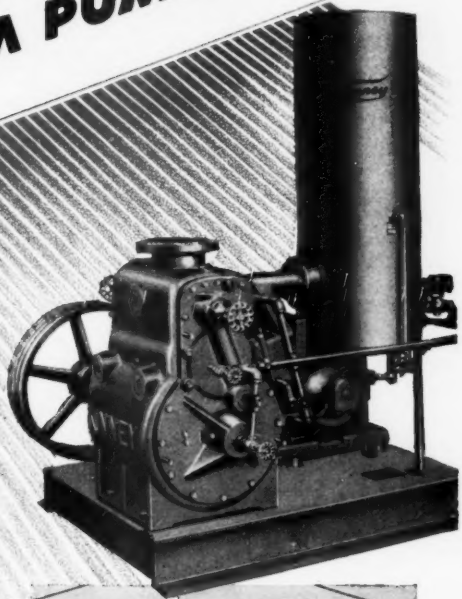
James H Mathews & Co, 3998 Forbes St, Pittsburgh 13, Pa.

P760 • WATER TREATMENT—*GS* water rectifier and descaler provides a water treatment for sterilizers, autoclaves, stills and instruments where metal surface must be kept sterile.

Metal coil is said to stop scale formation and remove old scale and rust. Further

IN HIGH PRESSURE, HIGH TEMPERATURE STEAM PLANTS

THE TREND IS TO KINNEY HIGH VACUUM PUMPS!



Eliminate "Hogging Jets"—Kinney Vacuum Pumps have ample capacity both for normal air removal and for pumping-down the unit when starting up.

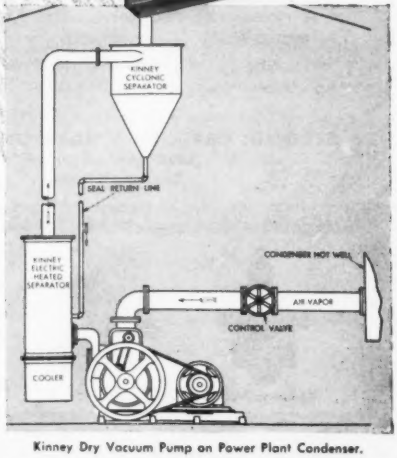
Automatic Push Button Control—Kinney Vacuum Pumps make possible remote control of condenser vacuum from a central control panel.

No Boiler Water Contamination—Kinney Vacuum Pumps remove caustic gas . . . eliminate possibility of ammonia gas concentrations.

No Troublesome Reducing Valves — Kinney Vacuum Pumps simplify auxiliary steam lines and piping layouts—banish reducing valve problems.

No Wastage of Condensate — Kinney Vacuum Pumps conserve boiler water—there is no contaminated condensate to discharge to waste.

Learn the whole story of Kinney Mechanical Rotary Vacuum Pumps for steam condenser operation in power plant service. Their dependability, high pumping speed, and economy are setting new standards in power plant operation. Write for Brochure "Use of Mechanical Vacuum Pumps in Central Station Operation" and Bulletin V45.



Kinney Dry Vacuum Pump on Power Plant Condenser.

KINNEY MANUFACTURING COMPANY

3532 WASHINGTON ST., BOSTON 30, MASS.

New York • Chicago • Cleveland • Philadelphia • Los Angeles
San Francisco

FOREIGN REPRESENTATIVES

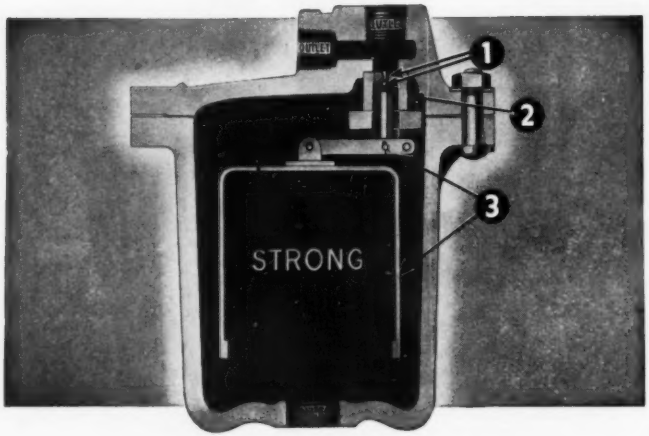
GENERAL ENGINEERING CO. (RADCLIFFE) LTD. . Station Works, Bury Road, Radcliffe, Lancashire, England
HORROCKS, ROXBURGH PTY., LTD. . . . . Melbourne, C. I. Australia
W. S. THOMAS & TAYLOR PTY., LTD. . Johannesburg, Union of South Africa
NOVELECTRIC, LTD. . . . . Zurich, Switzerland

WE ALSO MANUFACTURE LIQUID PUMPS, CUTOVER AND AIR-WINDING DISTRIBUTORS

3 Reasons

STRONG* Traps

are easy to maintain!



Look for these three STRONG low-maintenance features in the STRONG 80 Series Inverted Bucket Trap:

1. **Anum-Metl Valve and Seat—guaranteed leakproof for one year;**
2. **Bolted-in seat design—insures tight seal, easy servicing;**
3. **Stainless steel bucket and trim.**

Compare these features with other traps!

STRONG 80 Series Trap sizes ½" to 2½", pressures to 250 lbs., temperature to 500° F. (forged steel for higher pressures).

Dual outlet simplifies piping, bottom inlet keeps trap cleaner. Years of trouble-free operation assured by super-STRONG construction.

Catalog No. 68 describes inverted, open bucket and other types of STRONG traps. Write today.

*Trade Mark Reg. U. S. Pat. Off.

STRONG, CARLISLE & HAMMOND COMPANY
1392 West 3rd Street
Cleveland 13, Ohio

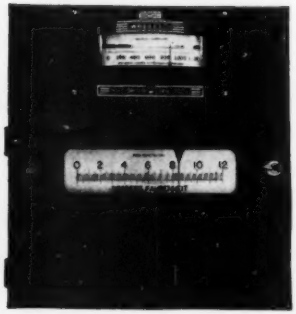
ANUM-METL Reg. Trade Mark

OTHER STRONG STEAM SPECIALTIES

Reducing Valve | 70 Series Trap | Strainer

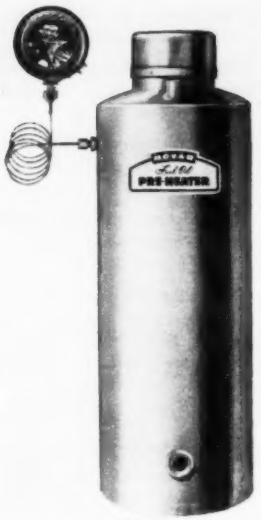
STRONG

claims are that it prevents foaming, priming, pitting and corrosion for at least one year. *GS* rectifier comes in two sizes, No. 1 for 8 qt of water, No. 2 for 30 qt. **General Scientific Equipment Co, 2700 W Huntington St, Philadelphia 32, Pa.**



P724 • CONTROL AND MEASUREMENT—Designed to measure and control process variables such as temperature, voltage, current, pressure, speed, etc, unit is supplied with four SPDT switches to select six different switching sequences.

High resistance, fully compensated, direct-reading meter movement with Alnico V magnet is used where application falls in pyrometric range. Models using resistance thermometer measuring systems are available for low-temperature operation. **Wheelco Instruments Co, 847 W Harrison St, Chicago 7, Ill.**



P737 • OIL PREHEATER — Electrically heated 4000 watt oil *Pre-Heater* can handle 50 gal per hr of No. 5 or 6 oils to eliminate need for oil heaters in main storage tank.

Pre-Heater is installed in oil-supply line and connected to a 220- or 440-v single-phase electric energy source. If the oil

the Diesel Cranking Battery designed specifically for the job

Exide Diesel Cranking Batteries discharge at high rates and maintain high voltage. Rugged construction keeps them steadily on the job, day after day, under the most rigorous service conditions . . . and in all climates.

Use Exide Diesel Cranking Batteries on trucks, buses and off-the-highway equipment . . . for railway and marine service . . . in power plants and other Diesel applications. Their use assures dependable performance, long battery life and low cost maintenance.

Exide engineers will be glad to help you solve any of your Diesel cranking problems.

1888 . . . DEPENDABLE BATTERIES FOR 61 YEARS . . . 1949

"Exide" *Reg. Trade-mark U. S. Pat. Off.*

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • *Exide Batteries of Canada, Limited, Toronto*

Here's the Equipment Which Will Give You

GREATEST EFFICIENCY and ECONOMY

in Metered Pressure Pumping of Chemicals for:

pH CONTROL
PRECIPITATION
STABILIZATION
CORROSION CONTROL
STERILIZATION
COAGULATION
ODOR, TASTE AND COLOR CONTROL
SLIME AND ALGAE CONTROL
DELIGNIFICATION CONTROL

- NO STUFFING BOX OR RUNNING SEAL
- HYDRAULICALLY-BALANCED DIAPHRAGM SEAL
- POSITIVE DISPLACEMENT PISTON MEASUREMENT
- FLOW RATE ADJUSTABLE WHILE IN OPERATION
- OIL-BATH LUBRICATION OF ALL MOVING PARTS
- UNITS AVAILABLE FOR MANUAL OR AUTOMATIC CONTROL

Lapp PULSAFEEDER

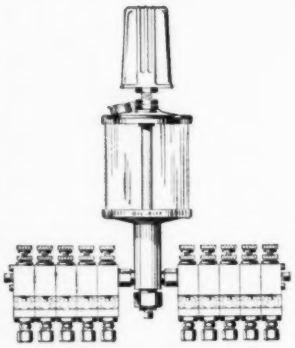
PISTON-DIAPHRAGM CHEMICAL PROPORTIONING PUMP

WRITE for Bulletin 262 with complete description and specifications.

LAPP INSULATOR CO., INC., PROCESS EQUIPMENT DIVISION, 148 MAPLE STREET, LE ROY, N. Y.

burner does not require 50 gal per hr the excess can be bypassed through a relief valve to storage where it lowers average viscosity of stored oil.

Boyar Products Corp, 104 E Charles Rd, Lombard, Ill.



P714 • AUTOMATIC OILER—Oil is released from reservoir by a solenoid-operated valve through single or multiple sight-feed valves to individual bearings to be lubricated. Solenoid connects line of the driving motor on machine whose bearings are to be lubricated.

When motor switch is turned on, lubrication of bearings starts immediately. Single reservoir feeds up to 24 bearings. Device is suitable for machine tools, punch presses, printing presses, conveyors, chain lubrication, etc.

Oil-Rite Corp, 3478 South 13th St, Milwaukee 7, Wis.

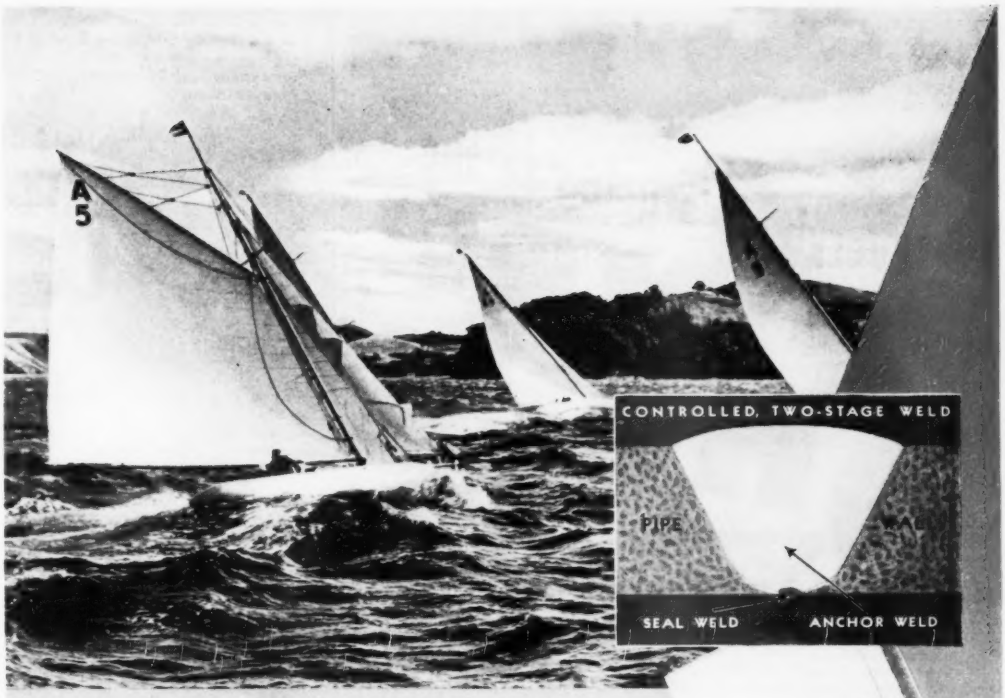
P860 • GUN-TYPE SAW—Reciprocating gun-type saw, to cut any material from rubber to stainless steel, has stroke adjustable to 2 in. It can be driven by air drill, electric drill, or flexible shaft.

Special guides for various blade widths, from ½ to 1 in., eliminate slipping and snapping. Saw has adjustable handle. Unit will swivel 360 deg and lock in any cutting tangent.

Transa Inc, Suite 440-445 Gateway Bank Bldg, Minneapolis, Minn.

P726 • PHOTOELECTRIC CONTROL—Designed to prevent jamming of cases and cartons on conveyors, photoelectric control and light are placed on opposite side of the conveyor, so when a moving case passes along the conveyor it interrupts the light beam.

Relay action of the photoelectric control occurs only when light beam is interrupted for a longer period than normally required for a case to pass. This long light interruption is caused only by several cases jamming, which stops the conveyor. Delay



Rough Going!

For the real sportsman, the rougher the going, the better he likes it. As a matter of fact, he'll go out of his way looking for "white caps" like these. However, for the maintenance engineer perplexed with piping problems, he'd just as soon look for "smooth sailing." Too often he finds "rough going" in welded pipe joints where protruding weldments constrict the size of the pipe I. D. and interfere with efficient and smooth flow. Also, there is always the danger of metal particles breaking off and getting into other equipment and causing more "rough going." That's not the case, though, when he uses the Mitchell-Westport Joint Method, the Controlled, Two Stage Welded Joint which prevents metal "icicles" on the inside of the pipe. The Westport Method consists of a seal and anchor weld that completely prevents constriction of the inside diameter at the joints without sacrificing maximum bondage or strength, and furthermore, it is done without the use of backing rings. Write for our bulletin, "Something New in Welding" and see for yourself how you can prevent the "rough going." While our shop prefabricated piping can be made with any type of weld, after you've read our bulletin, we believe you'll specify the Westport Method.

1899 • OUR 50th YEAR • 1949

REPRESENTATIVES IN BOSTON, NEW YORK, CLEVELAND, MOBILE AND HAVANA

WESTPORT JOINT

(PATENTED)

W. K. MITCHELL & CO., INC.

2944 ELLSWORTH STREET

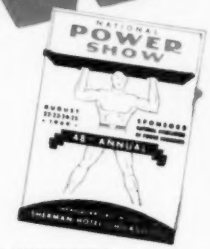
PHILADELPHIA 46, PA.

SINCE 1899

MITCHELL

PIPING FABRICATORS AND CONTRACTORS

*Everybody's going to the Power Show



CHICAGO
AUGUST 22 thru 25

*LAST CALL FOR EXHIBITORS:

Only a few more days . . . only a few more exhibit spaces . . . until your 1949 opportunity is gone . . . meet and sell the men who specify or buy steam and power generation, compressed air and materials handling equipment and supplies. Ask about FREE space for educational exhibits . . . FREE space to hold your own clinic . . . FREE space for film projection facilities.

Show them . . . Sell them . . .
with a Power Show Exhibit

Wire or telephone for space

A. F. THOMPSON
National Secretary, National Association of Power Engineers

Suite 1736, 176 West Adams Street
Chicago 3, Illinois

Telephone FRanklin 2-0836

★ COME YOURSELF

See the newest equipment . . . materials . . . ideas . . .

- Don't miss the big show . . . 1949's *only* national Power Show . . . with more exhibits . . . fascinating new equipment and materials . . . and a big special section for educational displays.
- Plan now to attend the show! Pack your notebook and be ready to jot down data on the latest developments in your own field.
- See you in Chicago . . . at the Hotel Sherman . . . at one of the greatest Power Shows in history!

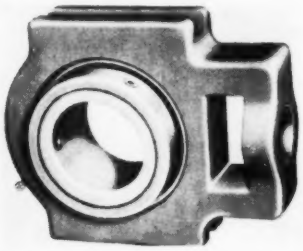
These famous names in the power field are among the exhibitors who made early reservations for space at the 48th Annual Power Show

Airetool Mfg. Co.
Alken-Murray Corporation
American Structural Products Co.
Apex Engineering Co.
Armstrong Machine Works
Babcock & Wilcox Co.
Barrett-Christie Co.
Brooks Boiler Treatment Co.
Bros Brothers Boiler Co.
Chicago Faucet Co.
Combustion-Engineering, Superheater, Inc.
Condenser Service & Engineering Co.
Corbett, Geo. E., Boiler & Tank Co., Inc.
Davis Regulator Co.
Dearborn Chemical Co.
DeZurick Shower Co.
Dowell, Inc.
Electric Auto-Lite Co.
Fairbanks, Morse & Co.
Flynn & Emrich Co.
Garlock Packing Co.
Graton & Knight Co.
Green Fire Brick Co.
Henricksen, C. O. Co.
Hills-McCanna Co.
Insto-Gas Corporation
Jefferson Union Co.
Kapsa, W. A. Co.
Kramer, Fred C. & Co.
Lammer & Mann Co.
Livingston Engineering Co.
Lowden & Company
Louis Allis Co., The
Lunkenheimer Co.
McNeill Engineering Co.
Mason-Neilan Regulator Co.
Metalock Repair Service, Inc.
National Aluminate Corp.
Nordberg Manufacturing Co.
Nevins, W. P. Co.
Otis Elevator Co.
Perfex Corporation
Pittsburgh Jointless Firebrick Co.
Power-Operating Engineer
Ramtite Co. Div. of S. Obermayer Co.
Roebling's, J. A. Sons Co.
Schaub Engineering Co.
Sexauer Manufacturing Co.
Shallcross Controls
Shell Oil Co.
Southern Coal Co., Inc.
Standard Oil Co. (Indiana)
Strong, Carlisle & Hammond Co.
Trostel & Sons, Albert, Co.
Vickers, Inc.
Walworth Co.
Winger Construction Co., Inc.
Wright Chemical Co.

SHOW HOURS: Aug. 22—1 PM to 10 PM
Aug. 23 thru 25th—10 AM to 10 PM

action intervals can be adjusted for 1/20 to 5 sec. The unit, including housing, is for plug-in connection.

Photoswitch, Inc, 77 Broadway, Cambridge 42, Mass.



P729 • TAKE-UP UNIT—For adjusting tension in conveyor belts this takeup unit has ball bearings. It consists of a deep-groove precision bearing with balls and retainer enclosed in an outer housing with wide milled slots on each end for supporting guides. Housing has a hole for the unthreaded end of an adjusting screw.

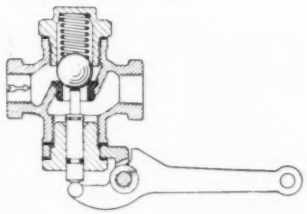
Takeup bearing is suitable for conveyor or power-transmission service requiring provisions for change of shaft position.

Dodge Mfg Corp, Mishawaka, Ind.

P764 • SOLDERING PLIERS—Faster, more positive soldering can be achieved with electric soldering pliers employing the current-resistance principle.

Wires or parts to be assembled are held by pliers; a foot switch, depressed for an instant, admits electricity to the pliers. Current resistance at point of contact between wires and soldering pliers melts the solder. Pliers always remain cool. Effectiveness ranges from 14 to 30 gage copper and includes silver-brazing of small parts.

Durst Mfg Co, 11110 Cumpston St, North Hollywood, Calif.



P740 • CONTROL VALVE—Type *BA-1* self-sealing ball-type valve is for air or water service. Valve is fitted with a quick-opening lever that may be adjusted

How the Alchlor Process makes GULFCREST a superior turbine oil —

1. The Alchlor Process is an extra refining step—weeds out more sludge-forming hydrocarbons than any other refining method.

2. The Alchlor Process imparts a greater ability to benefit from special inhibitors that control oxidation and prevent corrosion.

3. Result: An outstanding oil with long life and unmatched performance records.

In Cylinder 1 you see the oil that will become Gulfcrest. It has already gone through the usual steps used in refining most other turbine oils — but has not yet been Alchlor-processed.

In Cylinder 2 you see the part—approximately 15% — discarded by the Alchlor Process. This is the part that, when allowed to remain in turbine oil, is most likely to oxidize, increase neutralization number, and form sludge, emulsifiers, and harmful acids.

In Cylinder 3 you see the finished Gulfcrest—the incomparably pure lubricating oil that gives outstanding performance and helps you keep steam turbine systems clean indefinitely. To make it even finer, special inhibitors are added to it—they give it still greater stability and protect against corrosion.

Call in a Gulf Lubrication Engineer today and ask him to recommend the proper grade of Gulfcrest Oil to meet the specific requirements of your turbines. Write, wire, or phone your nearest Gulf office.

GULF INDUSTRIAL LUBRICATION

Gulf Oil Corporation • Gulf Refining Company

Division Sales Offices:

Boston • New York • Philadelphia • Pittsburgh • Atlanta
New Orleans • Houston • Louisville • Toledo

90% OPEN AREA
for light and ventilation

THE illustration shows the admission of light through three floors where the flooring is Hendrick Mitco.

Not only does pressure-formed Hendrick Mitco Open Steel Flooring have 90% open area, but there are no bolts, rivets or angle irons to collect dirt and refuse. The square-edge, uniformly spaced, rectangular steel bars provide a non-slipping, level walking surface. There is no lateral deflection, however heavy the loading, because each Mitco panel is a strong, integral unit.

SEE OUR CATALOG IN SWEET'S

HENDRICK
Manufacturing Company

Perforated Metals
Perforated Metal Screens
Architectural Grilles
Mitco Open Steel Flooring,
"Shur-Site" Treads and
Armorgrids

46 DUNDAFF STREET, CARBONDALE, PENNA.
Sales Offices In Principal Cities

JUST PRINTED

Two bulletins showing how
NEW G-E MOTOR EXCHANGE PLAN
cuts machine down time

Get the story of the new time and money saving General Electric exchange plan for Tri-Clad integral-hp motors! It's an extension of the highly successful G-E fractional-hp motor exchange plan and covers most popular types of Tri-Clad open dripproof motors—one to five hp. Bulletin GEA-5189 is for motor users; Bulletin GEA-5180 is for machinery manufacturers. Write on your letterhead FOR FREE COPY: *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

Look for this extra on the motors you buy; it means lower maintenance costs, less time lost for motor replacement.

GENERAL ELECTRIC

TS6-3

to any horizontal position. The ball closes tight with inlet pressure and will not collect dirt or other foreign matter.

Stem is sealed with an O-ring. Constructed with cast semi-steel body, integral rubber seat insert, screw connections, the valve comes in ½-in. size that can be bushed to ¼ or ⅜ in. Suitable for non-corrosive fluids up to 200-psi pressure and temperatures up to 150 F for air and 180 F for water, the valve can be used to control pneumatic cylinders, hoists, compressors, or for air-blast cleaning. **Leslie Co, 366 Delafield Ave, Lindhurst, N. J.**

P739 • HOUR RECORDER—Hourmaster converts revolutions per minute from one to 4000 into hours of operation.

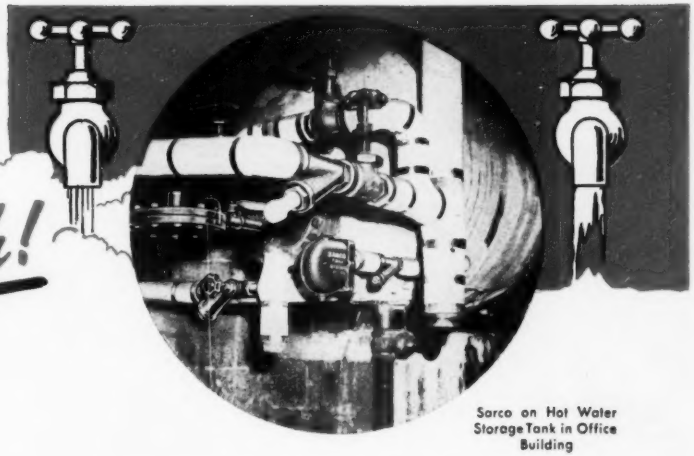
Space on the instrument is provided for record cards that can be used to accumulate service, production or maintenance records. Record assists in determining how often repairs and replacements are needed. **Barbour Stockwell Co, Cambridge 39, Mass.**

P742 • SEATLESS VALVE—A stainless-steel piston sliding into a ring effects positive closure because of its long sealing surface. Valve is suitable for low or high temperature range of −125 F to +750 F.

Sealing ring (usually made of laminations of compressed asbestos) is also available in material suitable for hard-to-

HOT WATER COSTS—

too Much!



Sarco on Hot Water Storage Tank in Office Building

Sarco Blender in Apartment

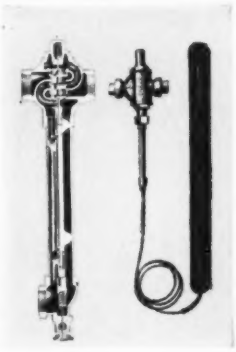
WHEN IT IS TOO HOT OR TOO COLD

Hot water is a critical service, in buildings, in homes, or in industry. Poor service can be "explained" for a time. But when tenants get scalded, or workers "wait for it to warm up" because the water is too cold, things begin to happen that cost you money every day.

The strange thing is that the proper applications of Sarco Steam Traps, Temperature Controls and Water Blenders not only eliminate complaints, but result in lower fuel and water costs.

TANKS

If you have a storage tank—any one of several Sarco Trap-Control combinations will insure constant tank temperatures. Sarco never over heats—therefore it saves fuel. The Sarco 2430 Control shown above is one method.



APARTMENT

The phone rang all day and the boss wanted to install an additional tank. We put in a Sarco Blender at a cost of less than a dollar per apartment — now no complaints and much less water is wasted waiting "for it to get right."

INDUSTRIAL APPLICATION

The Sarco Water Blender is doing a good job in industry too. It insures exact temperatures at the point of use. In foods, it saves raw materials and rejected batches by having the water just right at the cooker or mixer. It is used for recirculating brine and cooling water in engines and compressors, and is the standard for wash rooms and gang showers. Bulletin No. 800.

254

SARCO SAVES STEAM

SARCO COMPANY, INC.

Represented in Principal Cities

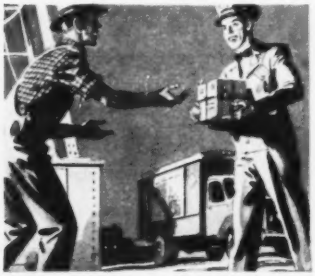
Empire State Building, New York 1, N. Y.

SARCO CANADA, LTD., TORONTO 5, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

$3.19 Air Express cost helped this wildcatter strike it rich!

When a pump valve goes while drilling for oil, it's costly. Idle men and equipment make profits evaporate. It happened to a wildcatter at 4 P.M. Phoned 800 miles away for parts—delivered 11 P.M. that night by Air Express. 12 lbs. cost only $3.19. (*Regular* use of Air Express keeps *any* business moving.)



$3.19 was *complete* cost. Air Express charges include speedy pick-up and delivery service. Receipt for shipment too. Makes the *world's fastest* shipping service exceptionally convenient.

Air Express goes on all Scheduled Airline flights. Frequent schedules—coast-to-coast overnight deliveries. Direct by air to 1300 cities, fastest air-rail to 22,000 off-airline offices.

Facts on low Air Express rates

Special dies (28 lbs.) go 500 miles for $1.30.
6-lb. carton of vacuum tubes goes 900 miles for $2.10.
(*Same day* delivery if you ship early.)

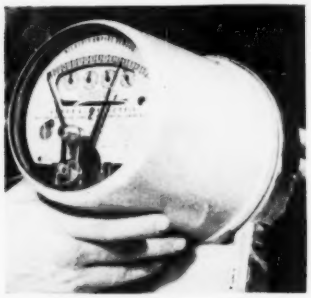
Only Air Express gives you all these advantages: Special pick-up and delivery at no extra cost. You get a receipt for every shipment and delivery is proved by signature of consignee. One-carrier responsibility. Assured protection, too—valuation coverage up to $50 without extra charge. Practically no limitation on size or weight. For fast shipping action, phone Air Express Division, Railway Express Agency. And specify "Air Express delivery" on orders.

SPECIFY AIR EXPRESS
AIR EXPRESS — GETS THERE FIRST

Rates include pick-up and delivery door to door in all principal towns and cities

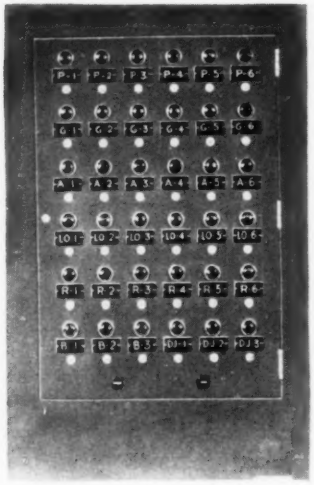
AIR EXPRESS, A SERVICE OF RAILWAY EXPRESS AGENCY AND THE
SCHEDULED AIRLINES OF THE U.S.

hold liquids or gases. Ring can be compressed against piston by a takeup on the bonnet while valve is in service.
Klingerit, Inc, 20 Hudson St, New York 13, N. Y.



P702 • WATTHOUR - DEMAND METER—Designated as the Type *IHE-1A*, the new meter is essentially the same size as conventional watthour meter; hence it can be installed without increasing size of original installation. It is available in the 50-amp 240-v 3-wire single-phase rating.

Watthour meter is essentially same as the *I-50* meter, except that rotating element is of conventional ball-bearing design. Thermal-demand meter unit consists of the thermal unit, a current transformer, a resistance valve, a potential transformer for exciting heater of the resistance valve, and the driving mechanism, pointers and scale.
General Electric Co, Schenectady 5.



P709 • ANNUNCIATOR—A new supervisory annunciator gives both visual and audible alarm when trouble develops. It is suitable for spotting overheated bearings, low fuel level, low or high pressures and high cooling temperatures.

Annunciator No. 1518 is for flush, surface or panel mounting, open or closed circuit operation, on voltages from 24 to

(Continued on page 210)

PLANT EQUIPMENT NEWS

Reader Service Page for New Products and Literature

Use the handy FREE service cards for additional information on this month's new products or for copies of latest trade catalogs.

AIR CONDITIONING, HEATING REFRIGERATION AND VENTILATING

A1 INDUSTRIAL DRIERS—J O Ross Engrg Corp, 350 Madison Ave, New York 17, N. Y. 32-page booklet No. 181 gives informative data about principles and processes of industrial drying. Illustrations of Ross driers as used in various industries are included.

A2 FORGED STEEL PURGER — Armstrong Machine Works, Three Rivers, Mich. 8-page folder No. 152 tells how the Armstrong forged-steel purger keeps refrigeration systems free of noncondensable gases. Installation data, specifications and prices, helpful charts and tables, and a brief description of other Armstrong refrigeration products are also given.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ DRIERS—Kemp Mfg Co, 405 E Oliver St, Baltimore 2, Md. 28-page catalog No. D-37 features a comprehensive discussion of desiccant-bed drying of air, gases and liquids. Also describes and illustrates special models such as bottled-gas drier, dri-breather, lab-master drier, and portable dehumidifier.

A3 COOLING EQUIPMENT—Marley Co, 2001 Fairfax Bd, Kansas City 15, Kans. 4-page folder No. DC-49 illustrates mechanical features and three basic designs of the new Marley DriCooler.

BOILERS AND AUXILIARIES

★ DIRECT-FIRED AIR PREHEATERS—Peabody Engrg Corp, 550 Fifth Ave, New York 19, N. Y. 8-page bulletin No. 600 is available to industrial and chemical engineers. It explains the Peabody direct-fired air heaters with full-color flow charts, cross-section drawings, typical applications and operating data.

B1 SPREADER STOKER — Detroit Stoker Co, General Motors Bldg, Detroit 2, Mich. 40-page catalog No. 290 covers installations of Detroit Roto-Stoker in power, process steam and heating plants, and includes applications to all kinds of boilers and steam generators.

B2 BOILER SEAM PROTECTOR — National Boiler Protector Co, 929 Rabolt Bldg, Dayton 2, Ohio. Folder, entitled "The National Boiler Seam Protector," describes this protector, which is installed to insulate riveted seams of hrt boilers.

B3 SPREADER STOKER — Detroit Stoker Co, General Motors Bldg, Detroit 2, Mich. 48-page bulletin No. 36 gives a complete description, including diagrams, of the Detroit RotorGrate stoker and its methods of operation.

CONTROLS, ELECTRIC

D1 ELECTRIC ALARM — Panalarm Products Inc., 7216 N Clark St, Chicago 26, Ill. 4-page booklet, entitled "Series 300 Panalarms," explains applications of Panalarm signal system which notifies operator when something is wrong. Diagrams of operation, specifications and list prices are also given.

HOW TO ORDER ADDITIONAL DATA

Be sure to fill out, completely, one coupon for each item of information you order. (See sample, right.) This gives your request authority and helps the manufacturer to address your copy completely.

When you have filled out completely one space for each item of information you want, detach along the scored lines and drop the cards in the mail.

Example

Write here number of item in which you are interested → E17

Your Company Name: Brown Mfg Co.
Address: 3718 First Avenue
Pottsville, Okla.
Your Name: John Smith
Your Title: Power Engineer
POWER, 330 West 42nd St., New York 18, N. Y.

FILL OUT AND MAIL TODAY! NOT GOOD AFTER NOV 1, 1949

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Write here number of item in which you are interested →

Your Company Name
Address
Your Name
Your Title
POWER, 330 West 42nd St., New York 18, N. Y. 8/49

D2 INDICATING PYROMETRIC CONTROLLER—Wheelco Instruments Co, 847 W Harrison St, Chicago 7, Ill. Bulletin MC-1 covers applications, measuring and indicating features, control functions, scale ranges, etc, of the new Multi-Switch Capacitrol, an indicating pyrometer controller.

ELECTRICAL EQUIPMENT

F1 AERIAL CABLE—General Electric Co, Advt & Sales Promotion Div, Construction Materials Dept, Bridgeport 2, Conn. 26-page catalog No. GEA-5157, entitled "Super Coronol Aerial Cable—Preassembled and Field Assembled," contains photographs, detail drawings, and charts pertaining to aerial cables used by electric utility companies. Also included are technical instructions concerning selection and installation of aerial cable, and splicing and terminating instructions.

F2 MOTORS—Allis-Chalmers Mfg Co, 953 S 70th St, Milwaukee, Wis. 8-page folder No. 51B6210B, entitled "The Inside Story of Allis-Chalmers 'Safety-Circle' Motor Protection," cites design and construction features of Safety-Circle drip-proof and splash-proof motors. Also gives dimension and specification chart.

F3 ELECTRICAL INSULATING MATERIALS—Owens-Corning Fiberglas Corp, Textile Products Div, 16 E 56th St, New York 22, N. Y. 24-page publication, "Manual and Catalog of Fiberglas Glass-Base Electrical Insulating Materials," describes Fiberglas and Fiberglas-base materials available for insulation of wire, cable and electrical equipment of all types. Charts and tables covering types of materials and properties, and a list of sources of the materials are included.

F4 FUSES—Trico Fuse Mfg Co, 2943 N 5th St, Milwaukee 12, Wis. Broadside No. 300-A features Trico fuses, fuse clip clamps, test clamps, fuse pullers, lubrication devices, etc. Also shows 18 ways to step up production and cut maintenance costs.

MAINTENANCE MATERIALS

L1 FLUIDS AND LUBRICANTS — Carbide & Carbon Chemicals Corp, 30 E 42nd St, New York 17, N. Y. 28-page booklet Form 6500 discusses various types of UCON poly-alkylene glycol lubricants and the use of these products for lubrication of many types of machinery, gears, internal combustion engines, rubber products, and instruments. Complete physical properties for both the water-soluble and water-insoluble grades of these synthetic lubricants are presented.

L2 HYDRAULIC PACKING — James Walker Packing Co, 96 Liberty St, New York 6, N. Y. 4-page folder tells about the Lion automatic hydraulic packing for high pressures. Also includes diagrams of the packing.

L3 FLOOR REPAIR—Flexrock Co, 3677 Filbert St, Philadelphia 4, Pa. Brochure cites how aircraft, railroad, marine and other industries are meeting floor repair and resurfacing problems with Ruggedwear applied over concrete, brick, stone, composition, steel or wood floors.

L4 FIRE HOSE—B F Goodrich Co, Akron, Ohio. 6-page catalog No. 3740 gives informative data on the methods and materials with which all Goodrich fire hose are constructed. Illustrations of each brand of industrial fire hose, data on size, couplings and test pressures are included. Gaskets, fittings and couplings used with the hose are also described.

MATERIALS HANDLING

M1 MAGNETIC SEPARATORS AND METAL DETECTORS—Eriez Mfg Co, 965 E 12th St, Erie, Pa. 12-page bulletin No. 14 presents complete line of Eriez permanent nonelectric magnetic separators and electronic metal detectors. Specifications regarding weights, sizes and strength comparisons as well as tables of operating capacities are given. All pieces of equipment are illustrated. Also discussed are factory engineering and laboratory services offered by the company.

M2 COAL PREPARATION — Link-Belt Co, 307 N Michigan Ave, Chicago 1, Ill. 28-page booklet No. 2255, entitled "Scientific Coal Preparation Methods and Equipment," shows installation views, flow-sheet diagrams and other ideas for low-cost handling and better preparation of coal at the mine.

M3 ALLOY CHAIN — S G Taylor Chain Co, Hammond, Ind. 12-page leaflet, entitled "Taylor Mede Alloy Steel Chain," contains complete specifications, working load limits, definitions and cautions, recommended uses and details of chain service for Taylor alloy steel chains, sling chains and attachments.

MECHANICAL TRANSMISSION

N1 GEARSHIFT DRIVES — Lima Electric Motor Co, Lima, Ohio. Folder No. DB-1 covers in detail Lima gearshift drives for selective-speed machine operation and cites compete type and gear ratio information. Also gives frame sizes and styles of Lima electric motors, and data on pedestal grinders; buffing and polishing lathes. All equipment is illustrated.

N2 SPEED CHANGER—Metron Instrument Co, 432 Lincoln St, Denver 9, Colo. A single-page bulletin No. 39 features the miniature variable-ratio speed changer. Description of adjustable-speed drive, operating principle, applications and design features are included.

N3 RIVETLESS CHAINS — Wilmot Engrg Co, Hazleton, Pa. 388-page catalog No. C461 gives informative data on the Keystone rivetless chains and attachments. Catalog also contains diagrams, specifications and dimensions of the Wilmot line of equipment including conveyors, elevators, shaft couplings, traction wheels, sprockets, safety collars, band brakes, pulleys, gears, pinions, sheaves, etc.

METALS AND ALLOYS

R1 MONEL AND NICKEL—International Nickel Co, 67 Wall St, New York 5, N. Y. A publication, entitled "Salt," presents diagrammatic production flow charts illustrating the wide use of monel and nickel to protect color and purity in salt refining. Also discusses how monel, nickel and nickel-clad steel are used for many components of the equipment involved, including evaporators, receiving tanks, centrifugals, rotary driers, filters, conveyors and heat exchangers.

(Continued on page 184)

FIRST CLASS
PERMIT No. 64
(Sec.510,P.L.&R.)
NEW YORK, N.Y.

BUSINESS REPLY CARD
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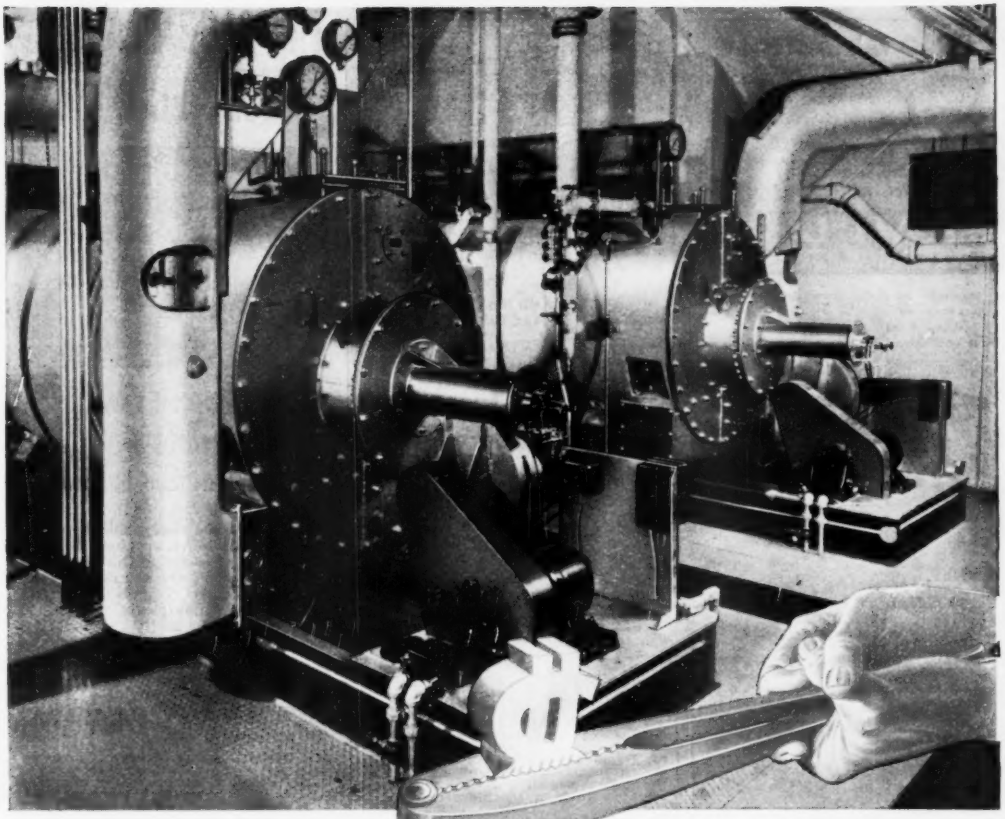


Put the Squeeze on

Steam Costs

NEVER forget boilers burn dollars — dollars that represent steam costs and a goodly share of your operating costs. Conditions today demand that you put the squeeze on steam costs along with your other costs. Begin with your boiler — investigate to see how much it is giving you for your fuel and operating dollars — see if it measures up in earning power as well as horsepower.

For any boiler installation (15 to 500 HP.) — new or replacement — Cleaver-Brooks offers these immediate and long range cost-saving advantages:

A Custom-Planned Boiler Engineered for Your Needs: Your steam needs and steam-using equipment are studied — your present total steam load plus your estimate of future expansion are considered — with this information the size of Cleaver-Brooks Boiler best suited to your specific needs is determined.

Factory Starting Service: Your boiler is placed in operation by Cleaver-Brooks factory service-engineers. Your operators are trained in operation, care and maintenance.

Flexible Operation Burning Gas or Oil With Equal Efficiency: You can use oil, gas, or combination oil and gas, whichever is of lower cost. Through their high heat transfer, Cleaver-Brooks boilers operate at a guaranteed efficiency of 80% from full load down to 30% of rating.

In addition, Cleaver-Brooks boilers give you clean, smokeless operation—eliminate fuel and ash handling — require no high or costly stacks — no special foundations — fit under low headroom — provide quick steaming, flexible operation to meet fluctuating loads — fully meet all codes.

Available in sizes 15 to 500 HP., 15 to 200 P.S.I. — write for Cleaver-Brooks steam boiler bulletin.

CLEAVER-BROOKS COMPANY
332 E. Keefe Ave., Milwaukee 12, Wis.

WRITE on your business letterhead for Steam Cost Calculator—a ready reference slide rule showing comparative steam costs when using oil, gas, or coal as fuel. Mailed on request — no obligation.

Cleaver-Brooks
STEAM BOILERS

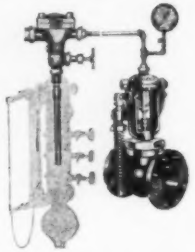
READ *this* ARTICLE

An article in the October 1948 issue of SOUTHERN POWER & INDUSTRY, page 79, tells about the boiler troubles of a Louisiana sawmill. As stated:

"Each boiler was supplied with a

CAMPBELL
Boiler Feed Water Regulator

—in which no floats, thermostats, or generators were involved in the design or construction. A continuous blow-down feature was incorporated in the unit."



Read the article itself. It concludes:

"The plant now has ample dry steam, with more excess fuel than can be burned under the boilers."

Operating Engineers Like These Six Points:

1—Continuous Blowdown;

2—No Moving Parts;

3—No Thermostats;

4—No Floats;

5—No Links;

6—No Generators.

The CAMPBELL has been controlling all types and sizes of boilers for many years—SUCCESSFULLY. Note the INDICATING GAGE (shown above) which can be placed on the switchboard or control board, showing what the regulator is doing at all times.

Slightest changes in water level cause the CAMPBELL to operate the largest control valves instantly. Rugged. Efficient. Economical. No fine adjustments. Easy to install. 50 to 400 lb. pressure and up.

Sizes 1" to 6". Guaranteed by a concern that has been in the regulating valve business EXCLUSIVELY for more than a half century.

Using the coupon below will save time

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE

289 SOUTH ST., NEWARK 5, N. J.

Represented in Principal Cities

☐ Without obligation, please send data on the CAMPBELL Feedwater Regulator. Also, please send complete information on the following ATLAS products:

☐ Damper Regulators	☐ Oil Control Cocks
☐ Temperature Regulators	☐ Humidity Controllers
☐ Exhaust Control Systems	☐ Thermostats
☐ Pressure Regulators	☐ Balanced Valves
☐ Pump Governors	☐ Control Valves

Name .....

Firm .....

Address .....

R2 **CONSTRUCTION MATERIALS** — Fischer & Porter Co, 97 County Line Rd, Hatboro, Pa. 4-page catalog section No. 97 lists materials of construction and packing materials for use with over 300 industrial liquids and gases. This tabulation of corrosion-resistant materials is up-to-date for ready reference.

R3 **NICKEL-ALLOYED CAST IRONS** —International Nickel Co, 67 Wall St, New York 5, N. Y. 36-page booklet, entitled "Engineering Properties and Applications of Ni-Hard," explains the service uses nickel-alloyed cast irons have in various industries. Properties and applications of Ni-Hard are fully illustrated, and a list of stock and service centers for Inco products is also given.

METERS AND INSTRUMENTS ELECTRIC

S1 **INSULATION TESTER**—James G Biddle Co, 1316 Arch St, Philadelphia 7, Pa. 24-page bulletin No. 21F8-24 illustrates simplicity of making insulation resistance measurements with a Megger insulation tester.

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **THERMOCOUPLE MANUAL** — Wheelco Instruments Co, 847 W Harrison St, Chicago 7, Ill. 40-page data book No. T/C 7 contains descriptions, prices and recommendations for thermocouples, heat-eyes, lead wire, thermocouple wire, heads, connectors, plug and socket assemblies, insulators, and profecting tubes.

METERS AND INSTRUMENTS MECHANICAL

T1 **RECORDER LINE**—Foxboro Co, Foxboro, Mass. 32-page bulletin No. 427 presents complete company line of Dynalog instruments for process measurement and control, as well as the various auxiliary devices that adapt them to their many industrial applications.

T2 **CHLORINIZER** — Builders-Providence Inc, 14 Codding St, Providence 1, R. I. 4-page folder No. 840-F2 discusses the Model DVS chlorinizer. Features, illustrations and operation data are included.

T3 **AIR METER**—Anemostat Corp of America, 10 E 39th St, New York, N. Y. 4-page brochure No. 25A explains the operation and application of the new Anemotherm air meter. Photographs show how the instrument is used to measure air velocity, air temperature and static pressure.

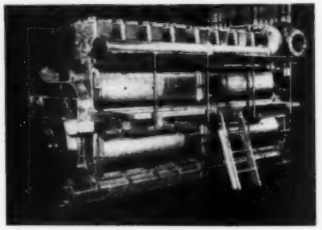
T4 **pH RECORDER** — Foxboro Co, Foxboro, Mass. 16-page booklet No. 430 describes and illustrates the equipment offered by Foxboro for the measurement and control of pH in industrial processing operations. The theory, which is applied in actual pH control instrumentation, is explained in text and diagrams.

T5 **FLOW METERS**—Builders-Providence Inc, 14 Codding St, Providence 1, R. I. 16-page catalog No. 406-F2 gives informative data on the Model SMDH Shuntflo meters for steam, air or gas. Cross-section views, typical specifications, capacity tables, correction factor charts and data sheet are included.

PIPING, FITTINGS, VALVES AND SPECIALTIES

U1 **UNIT FABRICATION**—Crane Co, 836 S Michigan Ave, Chicago 5, Ill. 4-page folder, entitled "Unit Fabrication," presents advantages and economies of factory unit-fabrication of welded piping headers, assemblies and valve groupings into one-piece pretested units. Plant facilities are discussed; sample unit-fabrications are shown and analyzed.

The ALCO PLAN for DIESEL ECONOMY



Flexibility and Low Cost Offered by ALCO Standardized Engine

THE ALCO plan helps Diesel plants where flexibility, economy, dependability, and provision for future growth are important. In one size of stationary Diesel engine, ALCO offers unusual advantages where multiples of 540 to 1,300 horsepower can be used.

LOW COST...This basic design, also used in ALCO switch engines, is quantity-produced to make both first cost and the cost of replacement parts unusually low.

FLEXIBILITY...You can fit fluctuating load curves more closely than with fewer engines of larger size, or of varied capacity.

LESS WEAR...This more efficient use of engines means less wear per installed horsepower. The unused capacity of operating engines at any time need not exceed the capacity of one engine. There is no wear on the idle engines. Larger engines would necessitate greater wear per installed horsepower, with resulting higher costs.

GREATER EFFICIENCY...With engines operating near rated load, fuel consumption is less and operating conditions are better.

UNIFORM ENGINE WEAR...With several units of the same size, engines can be operated in rotation, allowing planned inspection and maintenance with minimum "down time."

STAND-BY ECONOMY...When all units are the same size, stand-by capacity can be limited to one size of engine the same as all others. With a variety of engine sizes, stand-by capacity might easily have to equal the largest single unit.

SIMPLIFIED MAINTENANCE...Uniform engine size means uniformity of replacement parts and of maintenance procedures; smaller stocks of parts; minimum of special tools; shorter "down time."

EASY GROWTH...As demand increases, gradual growth can take place by adding extra units of the same size.

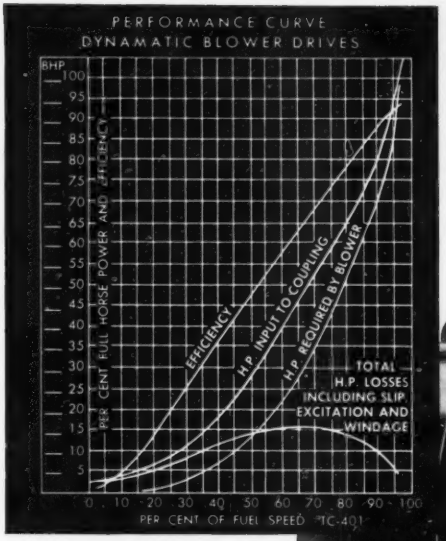
• • •

What your actual savings can be with this compact, efficient engine should be computed carefully. Call in an ALCO engineer to discuss the ALCO plan in relation to your needs.

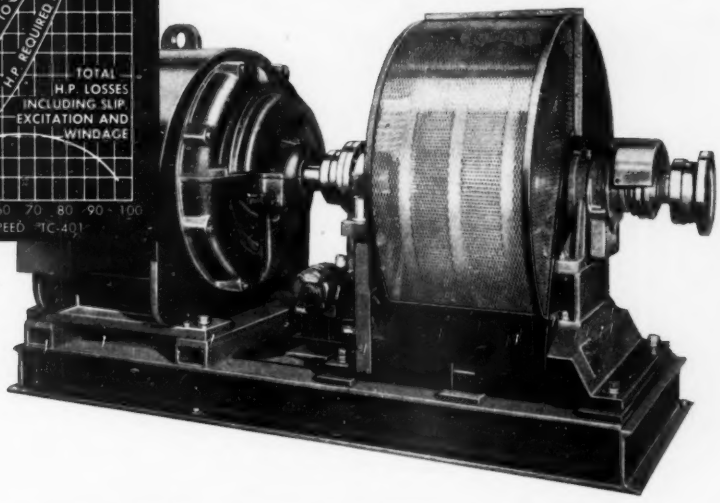
AMERICAN LOCOMOTIVE COMPANY

Department D-6, 30 Church Street, New York 7, N. Y.

ALCO
STANDARDIZED
DIESEL ENGINES



EATON DYNAMATIC BLOWER DRIVES



Instantaneous Response to Speed Control

Dynamatic Variable Speed Couplings are ideally adapted to such applications as regulating air drafts in steam generating stations, power house fan drives, public utility induced draft fans, and forced draft fans. Controls can be made to change the output speed of the coupling and hold that speed constant. Response is instantaneous and load changes are closely followed. The speed range available is practically infinite, and can be controlled precisely from ten per cent speed up to full speed.

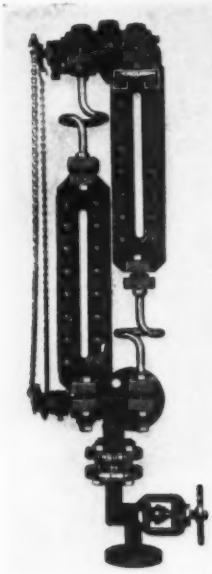
The performance curve above indicates the characteristics of Dynamatic couplings when driving fans or blowers. Fundamentally, all fans and blowers will have curves very close to the ideal curves shown in this figure. Note the desirable relationship between efficiency, horsepower input, and required horsepower. The horsepower losses indicated are normal for this type of application. Both air cooled and water cooled types of Dynamatic couplings are available, selection depending upon loads and type of service involved. The electric-slip coupling was developed and introduced by Dynamatic; this company has pioneered the use of electric-slip couplings in fan and blower drive applications. Write for illustrated literature.

EATON MANUFACTURING COMPANY • CLEVELAND, OHIO
ADDRESS INQUIRIES TO: DYNAMATIC DIVISION • KENOSHA, WISCONSIN

PRODUCTS: SODIUM COOLED, POPPET, AND FREE VALVES • TAPPETS • HYDRAULIC VALVE LIFTERS • VALVE SEAT INSERTS • ROTOR PUMPS • MOTOR TRUCK AXLES • PERMANENT MOLD GRAY IRON CASTINGS • HEATER-DEFROSTER UNITS • SNAP RINGS • SPRINGTITES SPRING WASHERS • COLD DRAWN STEEL • STAMPINGS • LEAF AND COIL SPRINGS • DYNAMATIC DRIVES, BRAKES, DYNAMOMETERS

JERGUSON HIGH PRESSURE STEAM GAGE

Rugged, Space-Saving Design, Expansion Coils, Other Special Features Insure Best High Temperature Performance



YOU'LL find that this Jerguson Model 618HP Gage will give you the kind of job you want in your power plant . . . rugged, efficient, uninterrupted, long life service.

You are assured of top performance because Jerguson has built the Model 618HP to meet the most exacting requirements of high temperature work. Both chamber and cover are rugged forged steel. At either end are specially designed Jerguson *expansion coils*. These coils, by absorbing excessive expansion and contraction, insure proper functioning of the gage under highest temperature conditions, and are another special Jerguson feature that assures you of highest accuracy and dependability. Valves on the Model 618 are for flanged or socket welding connections with outside screw and yoke.

Jerguson High Pressure Steam Gages are available in all pressures to suit your needs. The Model 618HP meets exacting Navy requirements and is now in use on scores of U. S. battleships and destroyers. It will pay you to investigate.

Jerguson offers a complete line of high pressure steam gages, inclined gages, and distance reading gages for power plant use. Write today, without obligation, for free illustrated DATA UNIT on the type of gage in which you are interested.

JERGUSON GAGE & VALVE COMPANY

100 Fellsway • Somerville 45, Mass.

Representatives In Major Cities . . . Phone Listed Under JERGUSON

All literature designated with a star (★) may be obtained only by writing direct to the manufacturer on company letterhead, giving writer's name and title.

★ **EXPANSION JOINT DESIGN GUIDE** — Chicago Metal Hose Corp, Maywood, Ill. 28-page booklet, entitled "Design Guide to Expansion Joint Selection and Application," is written in nontechnical language and contains numerous illustrations, charts and tables prepared for the purpose of simplifying the selection and application of expansion joints in piping systems.

U2 **AIR VALVES**—Gerotor May Corp, Baltimore 3, Md. 20-page catalog Section 301 illustrates the 21 different models that make up the complete line of Gerotor 4-way air valves. Description of each model valve includes working drawings, specifications for sizes, and cut-away views. Circuit layouts for important types of control show arrangement of all necessary air equipment with description of complete sequence of operation.

U3 **DIAPHRAGM CONTROL VALVES** — Minneapolis-Honeywell Regulator Co, Belfield Valve Div, Philadelphia 44, Pa. 31-page bulletin No. 700-1 contains informative data on the Belfield series 700 diaphragm control valves. Mechanical and flow characteristics of air-operated diaphragm motor-controlled valves are featured, as well as the standard and special control applications for diverse operating conditions.

U4 **STRAINERS**—Elliott Co, Accessories Dept, Jeannette, Pa. Bulletin No. A-13 explains and illustrates Elliott's new line of twin strainers. These strainers are built in sizes up to 24 in. for removing foreign matter from water, oil, and other liquids at pressures up to 125 and 250 psi.

U5 **STEAM TRAPS**—Armstrong Machine Works, Three Rivers, Mich. 8-page brochure No. 192 tells about correct application of steam traps on laundry and dry-cleaning equipment. Recommendations for the correct sizes of Armstrong traps for most of the widely used makes of steam-heated equipment in laundry and dry-cleaning service are given. Tables include the effect of air on steam temperatures and the high cost of steam leaks.

U6 **HAND-CONTROL VALVES**—Minneapolis-Honeywell Regulator Co, Belfield Valve Div, Philadelphia 44, Pa. 20-page booklet No. 242-1 gives complete descriptions of the Hi-Lift V-Port indicating-type hand-control valves. Details of construction, general features, applications and dimension charts are included.

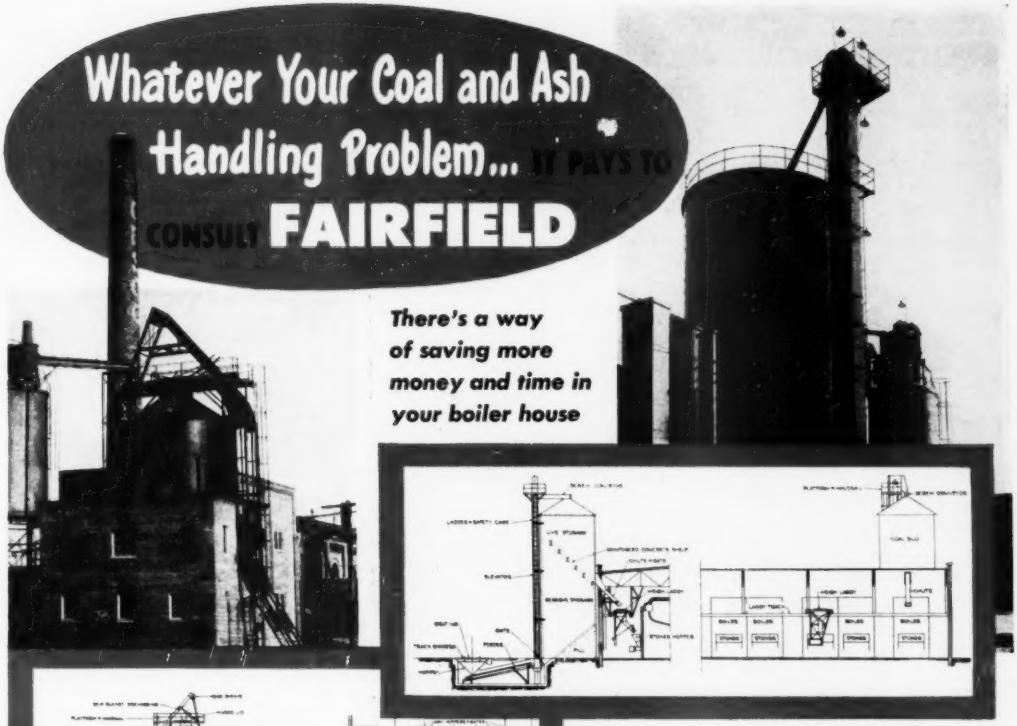
PUMPS

W1 **VERTICAL TURBINE PUMPS**—Worthington Pump & Machy Corp, Harrison, N. J. Bulletin No. H-450-B34 describes the water-lubricated Type Q vertical turbine pump—sizes 6 to 14 in. Pump sizes and capacities, standard specification, as well as a cut-away view of a typical section of a Type Q pump, are given.

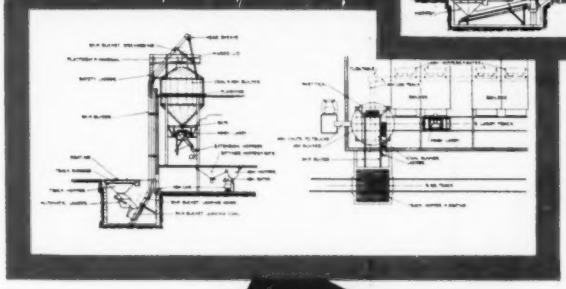
W2 **HIGH-VACUUM PUMPS**—Central Scientific Co, 1700 Irving Park Rd, Chicago 13, Ill. 48-page brochure No. 10A contains technical information and descriptive data on high-vacuum pumps and accessory apparatus, systems, connections, pumping speeds, etc. Also tells about the new Pressovac pump for pumping to 25 microns and the Cenco-Hypervac 23 pump, a fast-pumping unit for pressures to 5 microns.

W3 **CENTRIFUGAL PUMPS**—Worthington Pump & Machy Corp, Harrison, N. J. 4-page folder No. W-395-B1 covers self-priming centrifugal pumps. Specifications, pumping unit and engine data, and illustrations of several models are included.

Whatever Your Coal and Ash Handling Problem... IT PAYS TO CONSULT FAIRFIELD



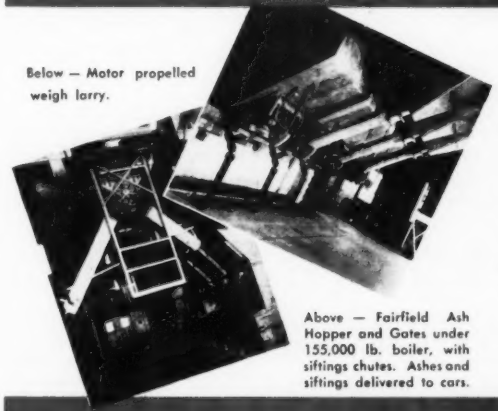
There's a way of saving more money and time in your boiler house



Above—Exterior of 500 ton Fairfield Silo System showing bucket elevator. Below—Silo System with live and reserve coal storage. Coal distributed by weigh larry.

Left —200 ton Cylindrical Bunker System with skip hoist. Left—Installation using skip hoist for coal and ash handling. Bunker has ash partition.

Below — Motor propelled weigh larry.



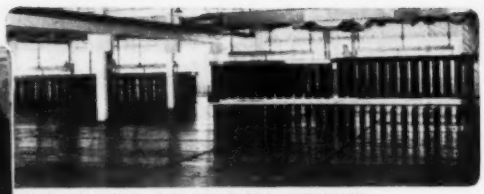
Above — Fairfield Ash Hopper and Gates under 155,000 lb. boiler, with siftings chutes. Ashes and siftings delivered to cars.

Top efficiency in all phases of plant operation is mandatory to meet today's competitive demands. Thousands of installations, each designed to cut dollars from power plant budgets are the reasons why you should consult Fairfield about your coal and ash handling problem. Taking advantage of Fairfield's engineering and construction experience is common practice among America's industrial plants. At no obligation to you, a Fairfield engineer will make a recommendation that will reduce costs in your plant. Write today.

THE FAIRFIELD ENGINEERING COMPANY

Builders of Dependable Coal and Ash Handling Equipment

Right: Ice-making Tanks
Below: Frozen Food Storage



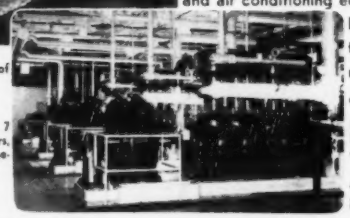
BIG PLANT AT NAMPA, IDAHO, MAKES 500 TONS OF ICE A DAY WITH FRICK REFRIGERATION

And quick-freezes 5 tons of fresh foods per hour at another plant, 600 feet away! Five cold storage rooms hold 2500 tons of ice and 85 carloads of frozen foods.

Seven large Frick ammonia compressors carry the cooling load. They were selected for this Terminal Ice and Cold Storage Co. plant by the Associated Refrigerating Engineers, Los Angeles consultants.

You can specify Frick refrigerating, ice-making and air conditioning equipment with confidence. Let us submit estimates on the cooling equipment you need. Write, wire, phone or visit

Above: Air View of Plant



Right: 5 of the 7 Frick Compressors, Totaling 1600 Horsepower

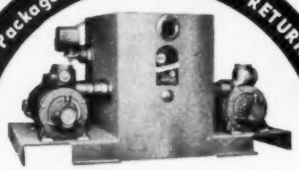
FRICK COMPANY
Waynesboro, Penna.
Also Builders of Power Farming and Sawmill Machinery

They DEMANDED — "an equally superb, but smaller, unit."

FOR THE SMALLER JOBS

We AGREED — and HERE IT IS!

APCO Packaged CONDENSATION RETURN UNIT



Packaged Duplex Condensation Return Unit Equipped with No. 4 Series Apco Pump.

Sizes up to 15,000 rated sq. ft. equivalent direct radiation

For above capacities, write for BULLETIN 113-ST

Ideally suited for the automatic return to low pressure boilers of hot water condensation from radiators, coils, etc.,—and for return of water and other liquids to the overhead tanks of gravity circulating systems in industry. Being UTTERLY SIMPLE—HIGHLY EFFICIENT—REMARKABLY TROUBLE-FREE and LASTING, APCO PUMPS establish new high standards of performance.

For larger capacities, write for BULLETIN 113

AURORA CENTRIFUGAL PUMPS

A complete line, notable for streamline coordination between impellers and shells, including Single and Two Stage Horizontally Split Case, Side Suction, Vertical, Non Clog, Sump, Mixed Flow, Special Design, etc.

DISTRIBUTORS IN PRINCIPAL CITIES

AURORA Always PUMPS

AURORA PUMP COMPANY

50 Loucks Street, AURORA, ILLINOIS

WATER TREATMENT

X1 STEAM AND CONDENSATE PURITY INDICATOR—E F Drew & Co Inc, Power Chemicals Div, 15 E 26th St, New York 10, N. Y. 6-page bulletin No. 11-23-48 RCU discusses various problems encountered with steam and condensate purity. Typical test apparatus and equipment available are listed and discussed.

X2 ANTI-FOAM TREATMENT — Dearborn Chemical Co, 310 S Michigan Ave, Chicago 4, Ill. 4-page leaflet No. 5008 covers the new polyamide anti-foam treatment No. 659. Illustrations of research developments and data on application are also included.

WELDING

Y1 WELDING SUPPLIES — Lincoln Electric Co, 12818 Coit Rd, Cleveland 1, Ohio. 8-page catalog No. 467 is a directory of Lincoln's line of welding supplies. A list of aids for design and production is also given.

Y2 BRAZING MATERIALS — Handy & Harman, 82 Fulton St, New York 7, N. Y. 4-page leaflet discusses Sil-Fos, a low-temperature self-fluxing, silver alloy, and Easy-Flo, 45 gage, silver-alloy brazing rings.

OTHER EQUIPMENT

Z1 PORTABLE ELECTRIC TOOLS—Independent Pneumatic Tool Co, Aurora, Ill. 4-page bulletin, entitled "Silver Line Portable Electric Tools," presents the Thor line of portable power tools giving specifications, sizes and prices.

Z2 GENERATORS—Kato Engrg Co, 1415 First Ave, Mankato, Minn. Two forms are offered containing information on ac generators. Bulletin No. 3149 describes ac generators ranging in capacities of 5 kw to 175 kw at 60 cycles, speeds from 720 to 1800 rpm, and also gives weights and dimensions. Bulletin No. 21749 describes ac generators ranging in capacities of 150 kw to 300 kw, speeds from 720 to 1800 rpm.

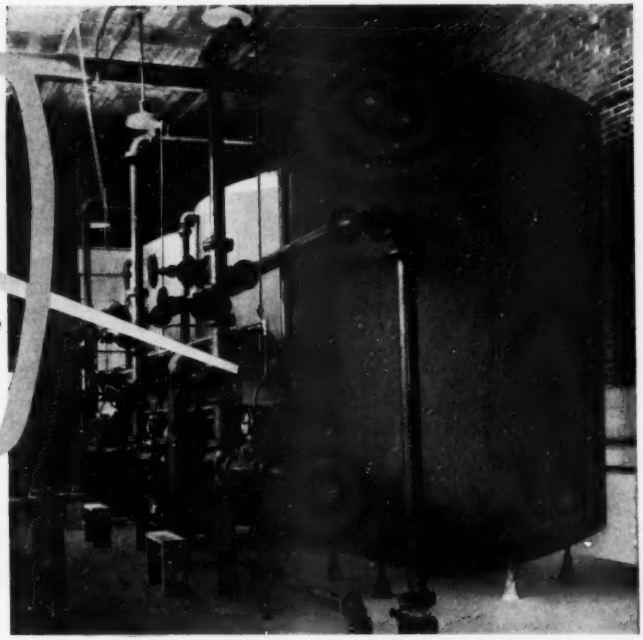
Z3 HEAT TREATMENT — Cooley Electric Mfg Corp, 38 S Shelby St, Indianapolis 7, Ind. Publication, entitled "Shop Notes on Heat Treating of Steels," is written in a nontechnical manner for shops without trained metallurgists. It gives informative data on typical heat-treating procedures including heating, quenching, tempering, and atmosphere control. Tips for better heat treating and definitions of heat-treating terms are also given.

Z4 PAGING SYSTEMS—Autocall Co, Shelby, Ohio. Kit of information covering paging systems contains catalog pages of bells, chimes, whistles, horns, and various models of Autocall central sending stations. Reproductions of photographs taken under actual business conditions to illustrate the service in users' establishments and comparisons of cost, maintenance, etc, between various types of paging systems are also included.

Z5 METAL FABRICATION — L O Koven & Brother Inc, 154 Ogden Ave, Jersey City 7, N. J. 24-page booklet No. 490 illustrates by photographs and sketches the complete story of Koven's experience, knowledge and facilities in the field of metal fabrication.

R J Miedel, president of Atlas Imperial Diesel Engine Co, announces acquisition of manufacturing assets of Lorimer Diesel Engine Co of Oakland. The company will establish the Lorimer div, which will be under direction of Ralph S Lorimer. It will be responsible for the sales, as well as manufacture of Lorimer engines and parts. This permits the company to offer a complete line of heavy-duty diesel engines ranging from 15 to 1000 hp.

ZEOLITE is right for purifying water here...



Worthington installation of three 8′ — 0″ dia. Sodium Zeolite Softeners put into operation in August, 1948 at Virginia Woolen Co., Middlebury, West Virginia. Here raw creek water is alum treated, settled, filtered and softened. Virginia Woolen Co. constructed its own filters.

. . . but it may not be right for <u>your</u> water treatment

This Worthington Ion-Exchange plant was installed for purifying water in this case, *only* after scientific analysis by Worthington engineers determined that it was the most economical process for Virginia Woolen Co.

In your case, there are so many variables involved that a similar analysis would have to decide which water conditioning process is right for you. Even within the ion-exchange process itself, there are many variables: what ions you want to get rid of . . . calcium, magnesium, sodium, bicarbonate, sulphate or chloride; whether or not you want alkalinity removed; whether you want ionized water comparable to distilled water. *Only* scientific study of your particular water conditions can determine the right process for you.

WORTHINGTON KNOWS ALL FOUR PROCESSES

Out of Worthington's century-old experience in engineering water handling equipment has come more knowledge and skill in solving complicated water conditioning problems than you can get anywhere else. And since Worthington alone makes every essential part of all kinds of water conditioning systems, you get the extra advantage that comes from placing complete control and responsibility in the hands of one reliable manufacturer.

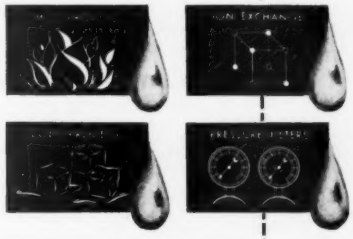
For complete details about the Worthington Ion-Exchange process, and further proof that *there's more worth in Worthington*, write for Bulletin W-212-B4. *Worthington Pump and Machinery Corporation, Water Treating Division, Harrison, New Jersey.*

J8-6

WORTHINGTON

WATER CONDITIONING

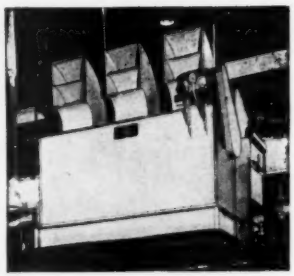
Worthington Makes More of the Equipment for All Types of Water Conditioning Systems



New HIGH PRESSURE STEAM Fan Heater

Gives Savings You Never Had Before

The first heater to make High Pressure Steam really trouble-free and practical in plant heating. Every engineer should understand its original method; write for Niagara Bulletin and performance data.



HOW IT OPERATES: — A dual coil system makes use of all heat, both sensible and latent. High pressure steam enters the upper coil, shown on the diagram below. Its condensate drains into a trap. Then this high pressure condensate is released into the header of the lower coil. It instantly flashes into steam at vapor pressure.

Any high pressure condensate that remains liquid is carried to the vapor condensate return header by a drain tube that also gives off its heat into the air stream.

The vapor condenses in the lower coil. Its condensate is kept at a high level in the return leg by a wier in the return header so that all its heat is made useful and it is sub-cooled by contact with the coldest air entering the heater. Vacuum condensate return to boiler is vapor free.

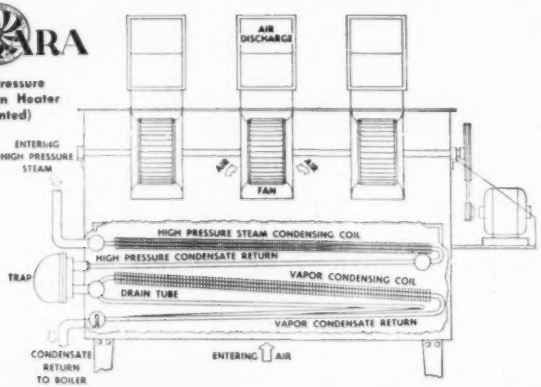
HOW IT SAVES IN COST: — Piping is much simpler and less costly than in low pressure systems. Much secondary piping, traps and big valves are not needed. Pipe sizes are smaller.

HOW IT SAVES IN OPERATION: — Waste is prevented. Every BTU goes where you want it. No dump traps or hot wells waste live steam.

HOW IT SAVES IN UPKEEP: — Condensate flow is even, vapor free, easily handled. No sudden surges of condensate in starting. No hammering, no hard wear and tear on system. Properly engineered for the job, final air temperatures are not excessive; heat easily directed where needed; no flashing of low pressure condensate. Heaters are self-draining on shut-down. Heaters are strongly built; all coils including the condensate drain tubes are hairpin bend, stress relieving. Use thru four heating seasons has proven these advantages in large scale plant heating.

NIAGARA

High Pressure Steam Fan Heater (Patented)



NIAGARA BLOWER COMPANY
Dept. P 405 LEXINGTON AVE., NEW YORK 17, N. Y.

Please send Bulletin 109 on the Niagara High Pressure Steam Fan Heater.

Name .....

Address .....

POWER NEWS

(Continued from page 130)

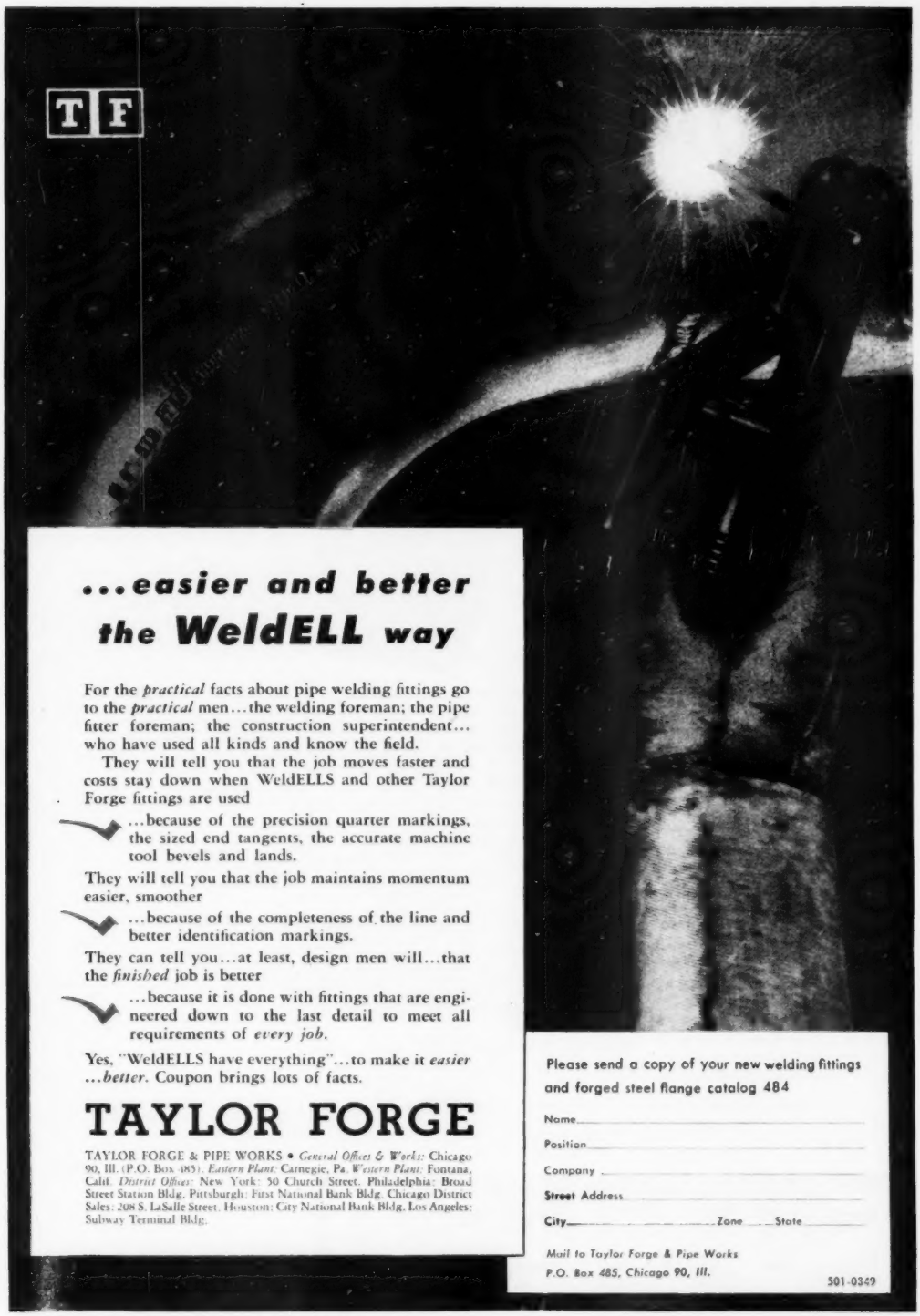
research frequently requires total darkness. Especially constructed louvers and ventilation systems keep fresh air coming into the room and keep out dust, harmful to test equipment.

The laboratory will investigate action of high-voltage discharges on solids, gases and liquids, study of lightning and its effect on electric apparatus, and transmission structures and development of new test methods. The laboratory will conduct studies of insulations for distribution and power transformers, as well as other equipment, to make them safe from lightning and other high-voltage overloads.

Productivity: Key to Plenty is a 16-mm, 2-reel, black-and-white, sound film produced by the Twentieth Century Fund and Encyclopaedia Britannica Films, by J Frederic Dewhurst and Associates. This film is an imaginative explanation of what productivity is and how it affects our standard of living. Ways of living are contrasted for 1850 and today. The gradual development of new energy sources and new industrial techniques is pictured. Finally, the film shows in both live action and animation how income, leisure and the good life as Americans know it rest on a base of constantly rising output per man-hour, which in turn rests on use of greater and greater power and new techniques. This film can be rented or bought. Write to *Twentieth Century Fund* 330 *W* 42*nd St, New York* 18, *N. Y.*, for further information.

The new American Standard Unified and American Screw Threads for Screws, Bolts, Nuts, and Other Threaded Parts (ASA B1.1-1949) was approved by American Standards Assn on Feb 23, 1949, and is the American fulfillment of the Declaration of Accord with respect to the Unification of Screw Threads signed at Washington, D. C., on Nov 18, 1948, by British, Canadian and American representatives. In addition to unified threads, which at present are limited to the coarse and fine series above ¼ in. dia, of the new classes of tolerance 1A, 2A and 3A for external threads and 1B, 2B and 3B for internal threads, the American Standard includes the numbered sizes in the coarse and fine series of Classes 2A and 2B and the extra fine and the 8, 12 and 16 pitch series that are standard in this country only, and the old Classes 2 and 3, which are continued for a transition period. Copies of this new standard may be obtained from *American Society of Mechanical Engineers*, 29 *W* 39*th St, New York* 18, *N. Y.*, *at $3 per copy.*

Jefferson Chemical Co has moved its executive and sales offices to new and larger quarters at 711 Fifth Ave, New York 22, N. Y. Jefferson is owned by American Cyanamid Co and Texas Co.



T F

...easier and better the WeldELL way

For the *practical* facts about pipe welding fittings go to the *practical* men...the welding foreman; the pipe fitter foreman; the construction superintendent... who have used all kinds and know the field.

They will tell you that the job moves faster and costs stay down when WeldELLS and other Taylor Forge fittings are used

...because of the precision quarter markings, the sized end tangents, the accurate machine tool bevels and lands.

They will tell you that the job maintains momentum easier, smoother

...because of the completeness of the line and better identification markings.

They can tell you...at least, design men will...that the *finished* job is better

...because it is done with fittings that are engineered down to the last detail to meet all requirements of *every job*.

Yes, "WeldELLS have everything"...to make it *easier ...better*. Coupon brings lots of facts.

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS • *General Offices & Works:* Chicago 90, Ill. (P.O. Box 485). *Eastern Plant:* Carnegie, Pa. *Western Plant:* Fontana, Calif. *District Offices:* New York: 50 Church Street. Philadelphia: Broad Street Station Bldg. Pittsburgh: First National Bank Bldg. Chicago District Sales: 208 S. LaSalle Street. Houston: City National Bank Bldg. Los Angeles: Subway Terminal Bldg.

Please send a copy of your new welding fittings and forged steel flange catalog 484

Name_____

Position_____

Company_____

Street Address_____

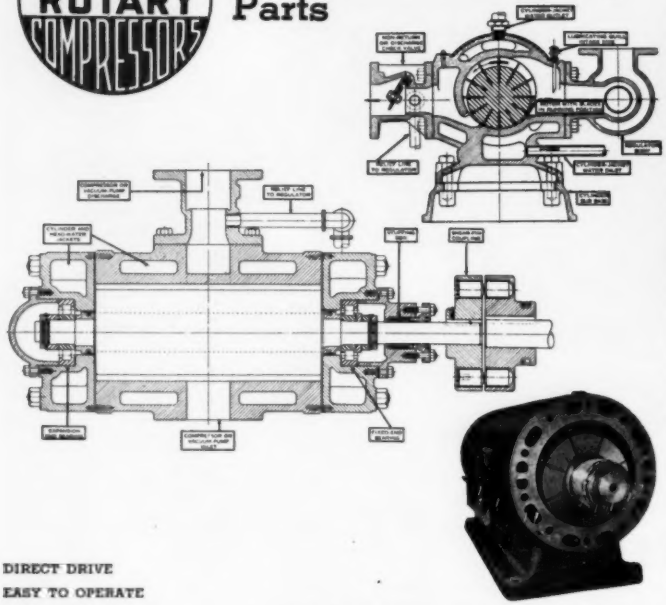
City_____ Zone____ State_____

Mail to Taylor Forge & Pipe Works
P.O. Box 485, Chicago 90, Ill.

501-0349

FULLER ROTARY COMPRESSORS

Rugged Construction · · · Simplicity of Design · · · Minimum of Moving Parts



DIRECT DRIVE

EASY TO OPERATE

LOW MAINTENANCE

SIMPLE FOUNDATIONS

NO BEARING TAKE-UP

SMALL SPACE REQUIRED

NO AIR-LINE PULSATIONS

PARTS READILY ACCESSIBLE

STURDY YET LIGHT IN WEIGHT

BLADES AUTOMATICALLY COMPENSATE FOR WEAR

NO VALVES TO LEAK OR SEATS TO GRIND

UNNECESSARY BULK ELIMINATED

MAINTAINED CAPACITIES FOR THE LIFE OF THE MACHINE

NO MULTIPLICITY OF PARTS REQUIRING FREQUENT ATTENTION, ADJUSTMENT OR REPLACEMENT

The fewer moving parts that make up any piece of equipment, the more continuous service at the lowest operating cost. Fuller Rotary Compressors are an outstanding example of simplicity of design . . . few moving parts: rotor—bearings—blades.

Ruggedly constructed, they will withstand long, continuous service and, after severe, gruelling operating periods, if inspection and check-up is desired, the machine design permits doing this easily and with a minimum loss of time.

Shut-downs are costly . . . lost time can never be recovered . . . install Fullers for day in and day out continuous service.

Fuller Rotaries are built for capacities to 3300 c.f.m. actual free-air delivery, 125-lb. pressure. For vacuums to 29.90-in. (referred to 30-in. barometer).

Write for Bulletin C-5. It's yours for the asking.

FULLER COMPANY, CATASAUQUA, PA.

Chicago 3 - 120 So. LaSalle St.

San Francisco 4 - 420 Chancery Bldg.

C-184

FULLER

A LIFETIME OF NEW MACHINE EFFICIENCY

Past President Harry Waite (right) presents the Robert Grimshaw Medal to past President William Wrightson (left)

William Wrightson Gets Robert Grimshaw Medal

For meritorious achievement in efficient power-plant and building operation William Wrightson was presented with the Grimshaw Medal for 1949, May 27th, by Greater New York Chapter, No. 1, National Assn of Power Engineers. Since April 1942 the recipient has been maintenance engineer for the Long Island College of Medicine, Brooklyn, N. Y. This college, as a community institution, carries on its teaching and research duties in a large group of buildings controlled by the cooperating organizations. Not only has Wrightson worked harmoniously with these various groups but discharged his engineering duties with dispatch and efficiency.

He has also had responsibility for rebuilding, revising and renovating quarters in the respective buildings for college use. These duties and requests have required considerable research as to the various possibilities and much ingenuity in making the many building changes.

The recipient has been a tireless worker for the National Assn of Power Engineers. He was president for two years, 1941 and 1942, of Greater New York Chapter, No. 1, and has served on many of its committees.

The medal was made possible by a gift of Robert Grimshaw, Ridgefield, N. J., one of the founders of the ASME and the first editor of POWER, 1884 to 1886. Mr Grimshaw afterward became a consulting engineer, serving the United States, French, New South Wales, Bavarian and Bohemian governments. He was also a director of the International Engineering and Trade Syndicate as well as the author of many technical works.

McGraw-Hill Publishing Co, 330 W 42nd St, New York, N. Y., has entered into an agreement with University Microfilms, Ann Arbor, Mich., to make available to libraries issues of a number of McGraw-Hill publications, including POWER, in microfilm form.

these National Coils have been "RAILROADED"

Field Coils (full AIEE Class "H" insulation) — which remain tight in the frame because they efficiently dissipate heat, withstand high temperatures and are pre-seasoned.

Armature Coils (full AIEE Class "H" insulation) — hotpressed; all Silicone, mica and glass insulated; for especially long, especially dependable service.

AND THEY'RE STILL GOING!

Typical of the exceptional dependability of National Silicone Mica-Glas field coils and armatures is the experience of one of America's leading railroads.

Half a million miles on a diesel-electric locomotive in freight service is often the limit for standard coils. Yet, when the motor with National Silicone Mica-Glass insulated field coils and National Silicone Mica-Glas insulated armature was inspected in their shops after 509,454 miles in freight service, they report:

"The field coils look to be in perfect condition. No sign of working on the pole pieces. The field circuit meggers infinity and clears our hi-pot at 3,000 volts. The armature shows a slight chafing of 3 or 4 coils at the pinion end of the slot. Wedges appear to be in perfect condition and tight. We are returning the unit to a passenger locomotive for further road service."

Everywhere in industry — steel, mining, central stations, railroads, manufacturing plants — National Silicone Mica-Glas insulation is setting new high performance records. If you want extra service from any rotating electrical equipment which faces an unusually rugged job, call in your nearby National field engineer. He'll bring you all the benefits of National experience — *first* in Silicone electrical application.

NATIONAL ELECTRIC COIL COMPANY

★ COLUMBUS 16, OHIO, U. S. A. ★

ELECTRICAL ENGINEERED MAKERS OF ELECTRICAL COILS AND INSULATION

PRODUCTION AND REPAIRING OF ROTATING ELECTRICAL MACHINERY

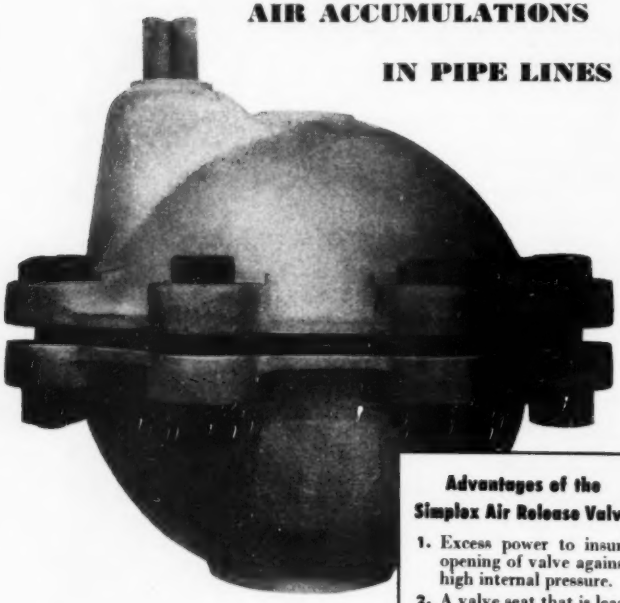
AIR RELEASE VALVES

FOR AUTOMATIC,

PERIODIC RELEASE OF

AIR ACCUMULATIONS

IN PIPE LINES



Whenever water is forced through pipe lines, under pressure, air in suspension is carried with it.

When air accumulations collect in high points in the line, the usable cross section area of the pipe is reduced and induces a friction factor—lowering the pumping capacity of the entire line.

Simplex air release valves are designed specifically to overcome these conditions and to provide for automatic and frequent release of air accumulations in pipe lines. For full information write to the Simplex Valve and Meter Co., Dept. 8, 6780 Upland St., Philadelphia 42, Pa. Ask for Bulletin 140.

Advantages of the Simplex Air Release Valve

1. Excess power to insure opening of valve against high internal pressure.
2. A valve seat that is least liable to stick shut or leak water.
3. A non-corrodible float that will not collapse or become disconnected from its lever.
4. Simplicity of construction, easy bearings and few parts.
5. Properly designed outlet port to prevent clogging by deposits of any kind.
6. Provision for draining without dismantling valve.
7. Sturdy construction, permitting rough handling.
8. Easy inspection of internal parts.

SIMPLEX

VALVE AND METER COMPANY

GE Announces New Price Reduction Plans

Reductions in net prices ranging from ½ to 7% on polyphase and dc electric motors and generators from one to 200 hp will be realized by most purchasers as a result of a new motor and control sales and discount plan announced by General Electric Co. The plan extends greater discounts to most purchasers served by the company. Larger-sized motors from 51 to 200 hp and dc motors were placed on a uniform discount schedule with that established for ratings of polyphase one- to 50-hp motors. To accomplish this, list prices were adjusted which, together with the longer discounts, result in over-all net price reductions.

The apparatus dept returned substantially to its prewar price policies, effective June 1, H V Erben, general manager and vice-president of the dept, has announced. Mr Erben pointed out that certain exceptions are necessary in the case of long delivery items. Transformers rated 15,000 kva and above, turbine-generator sets rated 15,000 kw and above, and Alco-GE diesel-electric locomotives, he said, will continue to be sold on the basis of "price in effect at time of shipment, with a 10% ceiling." Large hydraulic turbine-driven generators, synchronous condensers, and frequency-changer sets will be sold on basis of price in effect at time of shipment, with a 20% ceiling, he said.

"Consistent with its prewar policy on sale of light equipment with a short manufacturing cycle which frequently is purchased by future delivery orders," he declared, "the company will protect the purchaser on shipments made within 90 days after a price increase." This equipment includes distribution transformers, network transformers, lightning arresters, cutouts, and power-factor correction capacitors; watthour meters, instrument transformers, industrial controls, and induction motors rated from one to 200 hp.

All other apparatus dept lines of equipment, he said, will be sold "on the basis of the quoted price being maximum with provision for downward adjustment in the event of general price reductions in the particular product line." These lines include power transformers below 15,000 kva, all items of switchgear, integral, dc motors, synchronous motors, and induction motors above 200 hp; industrial heating, street lighting and welding equipment; industrial haulage locomotives and car equipments, turbine generators below 15,000 kw, and mechanical-drive turbines.

Almond H Snyder, chief design engineer for Gould Storage Battery Corp, was honored on completion of 50 years continuous service at a reception and dinner at the Lancaster Country Club, Buffalo, N. Y.

Southern Coal Co announces opening of its general office at 333 N Michigan Ave, Chicago 1, Ill.

Walsh Refractories Corp is now occupying its new general office at 101 Ferry St, St. Louis 7, Mo.

WORLD'S LARGEST PENNSYLVANIA BRADFORD BREAKER INSTALLED AT SEWAREN

PUBLIC SERVICE ELECTRIC & GAS (N. J.) BUYS 4TH PENNSYLVANIA IN 25 YEARS

—*ALL IN SERVICE*

For many years Public Service has had the opportunity to observe the performance and maintenance of Pennsylvania Bradford Breakers. Twenty-five years ago Public Service installed a 12′ x 22′ Pennsylvania Bradford Breaker at Kearny, N. J. That breaker is still giving top performance, handling 350-400 tons of coal per hour. The same year, 1924, Public Service also installed a 12′ x 19′ Pennsylvania Bradford at Essex — *it too* is still crushing and cleaning, 325-350 TPH. At Burlington, N. J., Public Service has had a 10½′ x 17′, 500 TPH Pennsylvania Bradford-Hammermill going since 1940.

Now Public Service Company has chosen this new 600 TPH Pennsylvania Bradford to crush and clean coal for the pulverizers at Sewaren. It is always good business to invest in equipment that lowers production costs. This, Pennsylvania does in a number of ways, particularly by cleaning coal of tramp iron and debris, thus protecting pulverizers and conveyors. Send for Bulletin No. 3007.

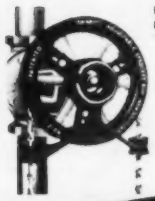
PENNSYLVANIA CRUSHER COMPANY

DIVISION OF BATH IRON WORKS CORPORATION

LIBERTY TRUST BLDG., PHILADELPHIA 7, PA.

New York • Pittsburgh • Chicago • Los Angeles • Birmingham—Associated with Fraser & Chalmers Engineering Works, London

Manufacturers of a complete line of crushing equipment • Hammermills • Single Rolls • Bradmills • Jaws • Gyracones • Granulators • Impactors • Bradford Breakers



SIMPLIFIES OVERHEAD VALVE CONTROL

Babbitt *Adjustable* SPROCKET RIM *with Chain Guide*

• Range of 10 adjustable sizes takes care of all valve makes and types; fits valve wheel diameters from 2 to 30 inches.

• **Pull the chain! That's all there is to open or close overhead valves—for complete control from the floor! Operating action of the BABBITT Adjustable Sprocket Rim with Chain Guide is as positive and instantaneous as that of direct manual control—and 100% safer because the dangers of climbing treacherous stepladders, or on benches, machines or boilers is completely eliminated.**

• **The BABBITT Adjustable Rim fits all valves, with either rising or non-rising stems. It is installed quickly by clamping onto the hand wheel of the valve.**

• *Write today for Catalog Bulletin P, surprisingly low prices, and name of nearest distributor.*

BABBITT STEAM SPECIALTY CO.
1 Babbitt Square, New Bedford, Mass.

industrial
OIL AND GAS BURNING EQUIPMENT

- Mechanical Atomizing Oil Burners
- Steam Atomizing Oil Burners
- Refractory Burner and Muffle Blocks
- Industrial Gas Burners
- Low Air Pressure Oil Burners
- Fuel Oil Pump Sets
- Valves, Strainers, Furnace Windows
- Tandem Block Combustion Units
- Combination Gas and Oil Burners

Detailed information gladly sent you upon request.

NATIONAL BURNER

AIROIL

NATIONAL BURNER COMPANY INC.

1250 East Sedgley Avenue, Philadelphia 34, Pa.
Texas Office: 2512 South Boulevard, Houston 6

APPOINTMENTS

Allis-Chalmers promotes Robert S Fleshiem to succeed J D Greensward as assistant to W C Johnson, executive-president of the company's general machinery div. Greensward replaces Frank H Stohr, who died last March, as general manager of the Norwood, Ohio works. In the electrical dept, Roy M Casper becomes manager of the dept; E E Ellis, manager of motor and general section; V J Egan, engineer-in-charge of motor and generator sales; and H H Roth, engineer-in-charge of large generator sales group.

Charles C Cheyney and Arthur M Kiely have been elected directors of **Buffalo Forge Co,** Buffalo, N. Y. Cheyney continues as sales manager and Kiely, as controller of the company.

Globe Steel Tubes Co, Milwaukee, Wis., announces following appointments: F K Krell, manager of sales, welding fittings; John F Scott, manager of sales, stainless and alloy tubing; John Koss, sales representative, Chicago district; and J J Lukens, sales representative, New York district.

J P Latimer joins staff of turbo-machinery sales div of **Clark Bros,** Olean, N. Y. A G Van Campen takes over management of Clark's Chicago office. R C McDonald is transferred from an associate company, Pacific Pump Wks, to replace Van Campen as sales engineer in the New York office. Also, A R Hauser, previously representing both Clark and Pacific Pumps in the Chicargo area, will devote all of his time to Pacific Pumps in the future.

C H Wheeler Mfg Co, Philadelphia, names Herbert G Johnson manager of its heat transfer dept. He will handle sales engineering of steam condensers, cooling towers and vacuum equipment.

Frederick H Mason Co, 1916 Ford Bldg, Detroit, Mich., sales and engineering representative of **Cochrane Corp** in the Michigan territory and the industrial area surrounding Toledo, is now handling Cochrane's C-B condensate drainage control system.

Electric Machy Mfg Co selects Alfred J Kroog as sales representative for the state of Georgia. His office is located at 902 W College Ave, Detatur, Ga. (Atlanta).

Resignation of J B Bray as chairman of the board of **Fairfield Engrg Co,** Marion, Ohio, has been announced. Bray will continue to serve as a director.

Oakite Products Inc, New York, N. Y., elects John A Carter president. D C Ball is chairman of the board and David S Ball, first vice-president. Re-elected are: H Ligget Gray—vice-president; James Beckett—treasurer; and David A Hearn—secretary.

Wilbert Otis Teeters has joined **M W Kellog Co** at the Jersey City laboratory of its petroleum and chemical research dept.

Ralph H Heberling, vice-president-in-charge of manufacturing of **Edward Valves Inc,** East Chicago, Ind., has retired. Also an-

How Power Capacitors may be used to improve power factor

HERE are ready-reference data on the fundamental working principles of power capacitors, the materials used in their manufacture, and the characteristics of the completed capacitor units. This book covers power capacitor design, operating limitations, and respective fields of application. The use of accessories such as fuses, circuit breakers, etc., with power capacitors is also considered.

Just Published

POWER CAPACITORS

By R. E. MARBURY

Westinghouse Electric Corporation

202 pages • 6 x 9 • $3.50

Westinghouse-McGraw-Hill
Engineering Books for Industry

THIS book provides a clear picture of the significance of "power factor." It covers high frequency capacitors for frequencies up to 12,000 cycles . . . capacitors for high voltage AC and DC power circuits. It discusses the gains that can be realized by raising the system power factor or the power factor of specific circuits.

A few of the topics treated:

- **Application of capacitors to industrial plants to reduce power billings**
- **Applications of capacitors to utility systems to improve system economics**
- **Problems associated with capacitor installations**
- **How automatic switching of capacitors greatly extends their usefulness**
- **The benefits of line compensation with series capacitors**

Examine the book 10 days—FREE!

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Send me Marbury's POWER CAPACITORS for 10 days' examination on approval. In 10 days I will remit $3.50, plus a few cents for delivery, or return the book. (We pay for delivery if you remit with this coupon. Same return privilege.)

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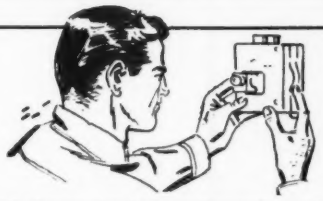
PROCEDURES ARE Easily Followed IN HALL BOILER WATER CONDITIONING

Maintaining proper boiler water conditions is a day-to-day job, and requires the cooperation of the men in the plant. By making procedures simple, and by carefully training *your own plant personnel,* Hall Laboratories makes this maintenance a relatively simple matter.

Hall Laboratories supplies written instructions, prepared so that any man competent to operate a boiler can understand them.

You get better cooperation from men when they know not only what to do but *why* to do it. Hall engineers, therefore, explain recommendations to your plant personnel so that they understand the reasons for the procedures recommended.



Hall Laboratories has continuously worked to simplify the testing of boiler water. Hall engineers train your men to make these tests quickly and accurately.

Hall supplies forms on which control test data are reported. Review of these reports by Hall Laboratories gives assurance that the recommended procedures are being maintained.

Careful instruction of personnel is one reason why plants small and large, manned by trained engineers or by men who have come up through the ranks, have found it profitable to use Hall Service. Hall Laboratories, Inc., Hagan Building, Pittsburgh 30, Pa.

HALL LABORATORIES, INC.

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CONSULTANTS ON
INDUSTRIAL WATER TREATMENT

HALL SYSTEM OF BOILER WATER CONDITIONING

INDUSTRIAL WASTE RECOVERY AND DISPOSAL

RODA

High grade gas, by-product and steam coal from Wise County, Va., on the Interstate Railroad.

DENDRON

High grade gas, by-product, steam and domestic coal from Wise County, Va., on the Interstate Railroad.

STONEGA

High grade, high volatile steam and by-product coal from Wise County, Va., on the Interstate Railroad.

PREMIX

A laboratory controlled product blended to meet exacting stoker requirements. From Wise County, Va., on the Interstate Railroad.

GLENBROOK

The Premium Kentucky High Splint unmatched for domestic use. Produced in Harlan County, Kentucky, on the L. & N. Railroad.

COKE

Roda and Stonega from Wise County, Va.

CRITERION COAL

High grade gas, by-product, steam and domestic coal—Pittsburgh seam from Irwin Basin, Westmoreland County, Pennsylvania, on the Penna. Railroad.

CROZER

Genuine Pocahontas from McDowell County, W. Va., on the Norfolk & Western Railroad.

LYNCO

High fusion coking coal for by-product, industrial stoker and pulverizer use from Wyoming Co., W. Va., on the Vgn. Ry.

Old Kentucky

Hazard No. 4 and No. 7 steam and domestic coal from Wiscoal, Knott County, Kentucky, on the L. & N. Railroad.

ANTHRACITE

Hazle Brook and Raven Run Premium Coal.

Our personnel with the experience gained through long and varied marketing activity assures effective servicing of any fuel requirement.

General Coal Company

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BRANCHES:

BLUEFIELD, W. VA. BOSTON BUFFALO CHARLOTTE, N. C.
CINCINNATI NEW YORK NORFOLK PITTSBURGH

nounced is appointment of Thomas J Williams sales engineer in the southwestern states. Williams will make his headquarters in Tulsa, Okla., with Rockwell Mfg Co, the parent company.

Bridgeport Brass Co opens new sales office in the Dwight Bldg, Kansas City, Mo. This office will be under direction of James G Miller.

Combustion Engrg—Superheater Inc, appoints H D Nickle manager of its new district office for the Northwest territory including the states of Washington and Oregon. The office is in Skinner Bldg, Seattle, Wash.

C F Taylor succeeds Don W Williams as branch manager of **Pennsylvania Flexible Metallic Tubing Co's** Los Angeles office. Williams is transferred to the company's Cleveland office where he will serve in the same capacity.

Manning, Maxwell and Moore Inc, Bridgeport, Conn., names C F Johnson maanger of valve sales. His headquarters are in Bridgeport.

William W Hopwood becomes vice-president of **Hagan Corp,** Pittsburgh, and its subsidiaries—Calgon Inc, Hall Laboratories, and Buromin Co. William R Kalbach assumes new duties in sales and service engineering for Hagan's Cincinnati district office. Charles A Mitchell transfers to take charge of new sub-district office at Baton Rouge, covering Louisiana and western Mississippi. Mitchell will be associated with Joseph W Eshelmann & Co, which represents Hagan and its subsidiaries in the South. In addition, Ash Engrg Co, Philadelphia district representative, is now at 246 S 15th St, Philadelphia.

Link-Belt announces new addresses of its district offices as follows: Cleveland office—314 Hanna Bldg, Paul V Wheeler, manager; Baltimore office—2315 St. Paul St, Charles C Wiley, manager; Huntington, W. Va. office—1009 Fifth Ave, David W Stevens, manager; and Newark, N. J. office—212 Essex Bldg, John D Riley, manager.

Gen B Somervell, president of **Koppers Co,** has been elected a member of the board of directors of Carborundum Co, Niagara Falls, N. Y.

Edward S Bus and R F Hutchinson have joined the sales staff of **Dearborn Chemical Co.** Bus will take over the Washington-Oregon territory and make his headquarters in Seattle. Hutchinson's territory will include western Iowa, Nebraska, and South Dakota. He will have his offices in Des Moines.

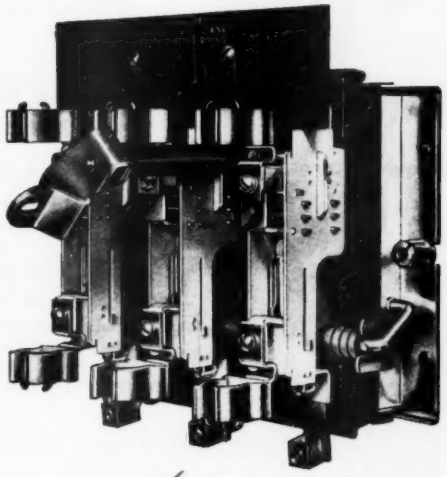
Plibrico Jointless Firebrick Co, Chicago, Ill., names H P Barnes manager of Plibrico Sales & Service Co, Pittsburgh and distributor of Plibrico refractory products. The office is at 921 Empire Bldg.

Worthington Pump & Machy Corp, Harrison, N. J., elects Hobart C Ramsey to succeed Clarence E Searle as president. Searle is now vice-chairman of the board

NOW...an ALL-NEW Type A Safety Switch for modern high-capacity distribution systems...

TRUMBULL'S HCI

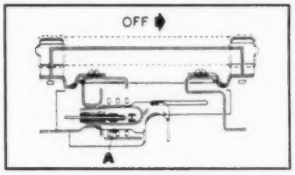
HIGH CAPACITY INTERRUPTER



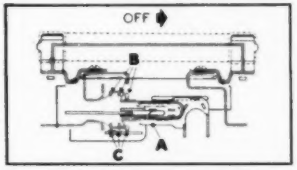
Unusually high interrupting capacity..."circuit-breaker" action breaks heavy loads quickly, safely. Extremely high momentary current capacity . . . withstands heavy short circuits without damage. 30-, 60-, 100-ampere sizes.

Here's How...

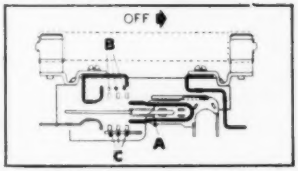
HCI's "Circuit-Breaker" Action Works



1. Switch closed. Spring-loaded sliding contact (A) fully inserted between stationary contacts. Red indicates current.



2. Sliding contact being withdrawn. The two arcs repel each other, are drawn against grid pins (B) and (C), which break and cool them.



3. Contact fully withdrawn. Trumbull's unique "Circuit-Breaker" action has effectively extinguished the arcs.

CHECK THESE ADDITIONAL SPACE-SAVING, TROUBLE-PREVENTING, LIFE-LENGTHENING FEATURES

Center-front operation permits close ganging.

Front fusing allows compact box, yet gives ample wiring space.

No exposed live parts when switch is OFF and door is open.

Handle interlock.

Clear ON and OFF markings both inside and outside.

No dead center—roller-cam action (multiplying linkage design with powerful spring) throws switch to full OFF and ON.

Poles are self-contained switching units for easy replacement.

Silver-plated current-carrying parts prevent oxidation . . . give low-resistance contact.

Insulating parts made of linen melamene, light, strong, arc-resisting.

Enclosed operating mechanism (on 60- and 100-amp. sizes) prevents wire chafing.

Interior removable for wiring ease.

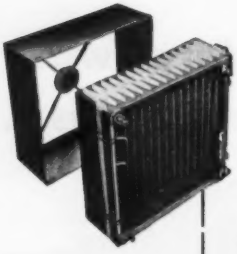
Underwriters' approval throughout.

For more information about Trumbull's all-new HCI Safety Switch, write for your free copy of Bulletin TEC-10 today. THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Connecticut.

Men Who Observe the Best Electrical Practice Make It a Practice to Use

TRUMBULL (T) ELECTRIC

TRUMBULL'S TRAINLOAD OF NEW PRODUCTS

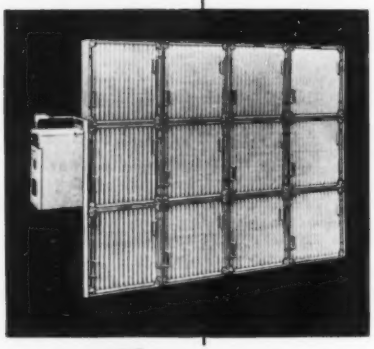


A new filter for air cleaning jobs that demand something better

New Electro-PL offers intermediate cleaning efficiency at lower first cost

THE new AAF Electro-PL filter is designed for those applications requiring better than normal air cleaning but do not justify the higher cost of super-clean air.

This dry-type electronic air filter averages 60% efficient by the Discoloration Method of Testing without the aid of an ionizing unit. Filtering media consists of Airmat* paper whose inherently high cleaning efficiency is almost doubled under electrostatic charge.



Elimination of ionizing unit assures a lower first cost, reduces power consumption and makes for simplified installation and maintenance. And with the Electro-PL on the job you enjoy positive protection at all times. If the electronic action should become inoperative, the air will continue to be filtered efficiently by the Airmat paper.

Read all about it!
New dry-type electronic air filter delivers high cleaning efficiency without aid of ionizer. Complete information contained in Bulletin 247. Write for it!

Intermediate efficiency with positive around-the-clock protection, they're yours for the first time in the Electro-PL at a pocketbook pleasing price. See your local AAF representative for complete details or write direct to:

AMERICAN AIR FILTER COMPANY, INC.
201 Central Avenue, Louisville 8, Ky.
In Canada: Darling Bros., Ltd., Montreal, P. Q.

AAF
AIR FILTERS
AND ELECTRONIC PRECIPITATORS

*Airmat is the trade-mark (Reg. U. S. Pat. Off.) of the American Air Filter Company, Inc., for various air filters, dust collectors, and filtering media.

of directors. Succeeding Ramsey as executive vice-president is Edwin J Schwanhausser. Also, John J Summersby is made vice-president-in-charge of sales and Thomas J Kehane, assistant vice-president and general sales manager.

Grant E Scott Jr becomes assistant sales manager for **Klipfel Valves Inc,** div of Hamilton-Thomas Corp, Hamilton, Ohio. Scott will serve as assistant to Frank Breor, sales manager of the division.

Tube Turns Inc has moved its Los Angeles branch office to 612 S Flower St. Manager of this branch is Norton P Bosemer.

General Electric announces following appointments: John W Belanger and Nicholas M DuChemin are now assistant general managers of the Apparatus dept. Glenn B Warren succeeds Belanger as manger of turbine divisions. Warren, in turn, names Edwin E Parker to succeed him as manager of engineering of turbine divisions. DuChemin is replaced by Harold E. Strang as manager of meter and instrument divisions. W J McLachlan assumes duties of D M Jones, retired, as manager of central station engineering divisions. Also, Francis K McCune becomes assistant general manager of the G-E nucleonics dept. C W Pierre is appointed assistant manager of aircraft gas turbine divisions.

Peter Storti has been named rotary oil burner development engineer of **Iron Fireman Co,** Portland, Ore. He will make his headquarters at the home office in Portland.

Koppers Co, Pittsburgh, Pa., promotes J I. Tunstead to sales manager of its metal products div. He fills vacancy created by death of McMillan Robinson last April 4.

Clarence W Daniels, plants engineer and a director of **Norton Co,** Worcester, Mass., retired June 1. He is succeeded by Allan F Hardy Jr. Daniels will continue to participate in management of the company as a member of the board of directors.

Westinghouse Electric Corp reports following executive changes: L E Osborne is assigned staff supervision over all the company's manufacturing activities. Simultaneously he retains operating responsibility for five major manufacturing divisions. James H Jewell, recently elected vice-president, takes over staff supervision of all sales and marketing on a company-wide basis. John K Hodnette becomes general manager of industrial products with headquarters at Pittsburgh. John M McKibbin, also a recently elected vice-president, is appointed general manager of consumer products with offices at Pittsburgh. Both Hodnette and McKibbin report directly to the president.

Three executives who will hold key responsibilities in the sale and engineering of **WE** industrial products are: Tomlinson Fort, manager, apparatus sales dept; William W Sproul, sales manager, industrial products; Royal C Bergvall, engineering maanger, industrial products. They will report to John K Hodnette. In addition,

THERE'S NO PLACE FOR THESE TROUBLEMAKERS • •

IN PLANTS THAT CAN MAKE A STATEMENT LIKE THIS • •

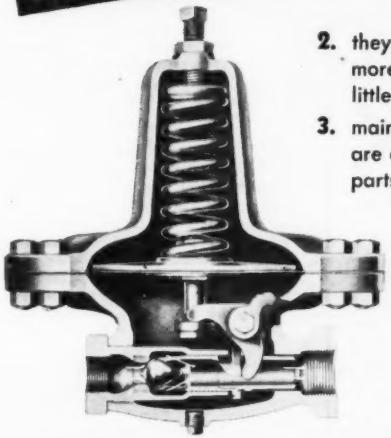
"We use your Streamlined '1000' Valves on the following equipment:

Heating Systems
Solution Heaters
Plating Tanks
Degreasing Machines
Hot Water Heaters

CASH STANDARD *Streamlined* TYPE 1000 PRESSURE **REDUCING VALVE**

"We use them:

1. because they hold close delivery pressure control.
2. they don't get gummed up, so we get more and better production with very little lost time.
3. maintenance cost is very low—the guts are cheap—old parts come out and new parts go in easily with little time lost."



ITS ASPIRATOR AND STREAMLINED FLOW WORK TO YOUR BENEFIT IN THESE 12 WAYS . . .

1. Maximum Capacity when needed most. 2. Accurate Pressure Control under toughest working conditions. 3. Trouble-free Service. 4. Smooth Operation. 5. Tight Closure. 6. Accurate Regulation. 7. Speedier Production Results. 8. Elimination of Failures. 9. Constant Delivery Pressure. 10. Cost Saving Operation. 11. No Spoilage. 12. Practically zero in maintenance costs.

CASH STANDARD CONTROLS . . . VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

•

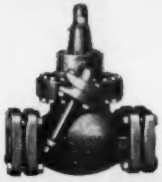
BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES

Send for them

•

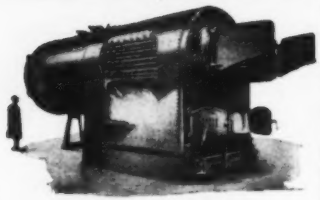
Bulletin 963 features the CASH STANDARD Type 100 Series of Super-Sensitive Controllers — various types for automatically operating valves, dampers, rheostats, stokers, pulverizers, fans, and other apparatus. 16 pages filled with descriptions and applications.

Bulletin 968 features the CASH STANDARD Type 34 Pressure Reducing Valve — direct operated — direct acting for handling steam, hot water, cold water, air, oil, brine—and most liquids and gases except some injurious chemicals. Illustrates and describes the different styles available and tells about their applications. Three pages of capacity charts.



Bulletin 956 features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.

KEWANEE
HEAVY-DUTY



10 to 304 hp
100, 125 and 150 lbs wp

Has all the characteristics which make firebox boilers ideal for high pressure. Complies fully with ASME and SBI codes.

Outstanding for extra years of dependable service in producing hi-pressure steam economically with Oil, Gas or Coal.

WRITE Department 96-K8 for 6" scale with pipe diameter markings

KEWANEE BOILER CORPORATION
KEWANEE, ILLINOIS
Division of American Radiator & Standard Sanitary corporation

jefferson
UNIONS
with the RECESSED BRASS SEAT *make up tight without undue pressure*

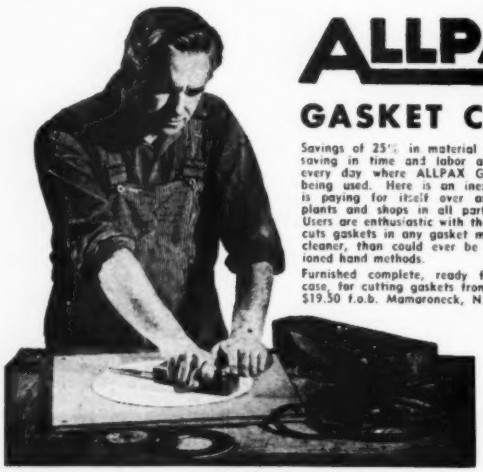
Male-Female Union

Jefferson Unions, of high tensile strength air-refined malleable iron, are made with a channel for receiving a Recessed Brass Seating Ring. This channel is machined (not cast) for precision smoothness. The fit of the ring in the channel is such that the ring cannot bulge or sag. This construction assures leak-proof tightness without having to exert undue pressure when making up. It costs more to make such a joint, but it pays higher dividends in better performance and service.

Ask your nearest distributor for full information . . . or write us direct.

JEFFERSON UNION CO.
605 W. 26th St., New York 1, N. Y.
63 Gooding St., Lockport, N. Y.
39 Fletcher Ave., Lexington 73, Mass.

Save Time, Material and Labor . . . . .
by cutting gaskets the modern way



ALLPAX
GASKET CUTTER

Savings of 25% in material and a tremendous saving in time and labor are being recorded every day where ALLPAX Gasket Cutters are being used. Here is an inexpensive tool that is paying for itself over and over again in plants and shops in all parts of the country. Users are enthusiastic with the way the ALLPAX cuts gaskets in any gasket material faster, and cleaner, than could ever be done by old-fashioned hand methods.

Furnished complete, ready for use, in metal case, for cutting gaskets from 1" to 36". Price $19.50 f.o.b. Mamaroneck, N. Y.

30-DAY FREE TRIAL OFFER
Write for details.

THE ALLPAX CO., INC. *Mamaroneck, N.Y.*

Herbert P MacDonald, elected assistant treasurer, is now also credit manager of Westinghouse and will make his headquarters in Pittsburgh.

Whiton Machine Co, New London, Conn., announces promotion of Stanley E Peterson to vice-president and secretary, and Walter E Beaney to vice-president and factory manager.

J F Wulfetange Jr, 317 State St, Syracuse 2, N. Y., has been chosen eastern New York representative for **Automatic Control Co.**

Youngstown Sheet & Tube Co names D L Markle Jr to succeed Orville B Ewing, who died recently, as district sales manager in charge of the New Orleans office. Robert J Mullally, district sales manager in charge of the Detroit office, retired and is replaced by C Hix Jones.

Gerald A Fleet becomes district manager for **American Well Works.** He serves the New York district, including the metropolitan area, northern New Jersey, and southeastern New York, from the company's offices at 475 Fifth Ave, New York City.

Ampco Metal Inc, has selected the following distributors for its products: Omaha Welding Co, 1523 Marcy St, Omaha, Nebr., and Pye-Barker Welding Supply Co, 231 Pryor St, S W, Atlanta, Ga.

F William Harder is elected to board of directors of **American-Marietta Co,** Chicago, Ill. Harder, who lives in Glen Ridge, N. J., is also director of American Bosch Corp and assistant to chairman of the board of Colorado Fuel & Iron Corp.

Air Reduction Sales Co, New York, N. Y., promotes Richard N Chapin to succeed Walter R Clark, who resigned, as general purchasing agent. Chapin will be at the firm's general offices in New York City. S S Stewart assumes duties of purchasing agent, manufacturing div, with headquarters at 125 Monitor St, Jersey City, N. J.

John F Ducey Jr and Sam R Watkins have been appointed district sales managers of brake shoe and castings div, **American Brake Shoe Co.** Curtis C Gary has been made president. Both Ducey and Gary will be in New York City and Watkins will be in the Cleveland, Ohio sales office. Roger W Batchelder has become vice-president in charge of sales of the national bearing div. He will remain at the division headquarters in St. Louis, Mo.

Cutler-Hammer Inc opens sales office at 504 Broadway, Gary, Ind. F J Burd will manage the office as a branch of the company's Chicago district sales office. H Kolar will assist Burd.

C A Staub is now treasurer of **Cornell-Dubilier Electric Corp,** with headquarters in South Plainfield, N. J.

Ansul Chemical Co will offer sales and service for Ansul dry chemical fire extinguishers in the Pacific Coast states, formerly served by Snowden Chemical Co. Ansul has opened offices in Los Angeles, Fresno and

Yes, it's Youngstown!

Dependable Steel Pipe
The Pipe-Fitters Friend

FOR 45 years, Youngstown Steel Pipe has served plumbing and heating contractors dependably--enabling them to furnish adequate water and heating systems to customers at lowest cost.

Whether you use a few feet or thousands of miles of Youngstown Steel Pipe, you can depend on its uniformity--uniform in metallurgical and chemical properties for easy, accurate bending, cutting, welding and threading--uniform in diameter and roundness--cut to uniform lengths--uniformly smooth inside for minimum friction--in short, *uniformly satisfactory.*

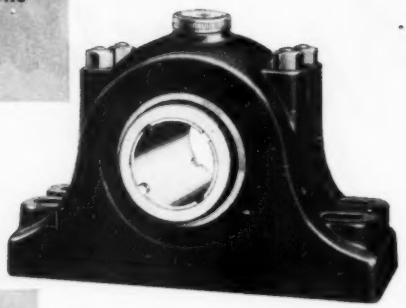
Youngstown
STEEL PIPE

THE YOUNGSTOWN SHEET AND TUBE COMPANY — General Offices — Youngstown 1, Ohio

Manufacturers of Carbon, Alloy and Yoloy Steel — Export Office - 500 Fifth Avenue, New York

PIPE AND TUBULAR PRODUCTS - CONDUIT - BARS - RODS - COLD FINISHED CARBON AND ALLOY BARS - SHEETS - PLATES - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RAILROAD TRACK SPIKES.

Quality-proved by use on millions of industry's toughest jobs



Mounted, sealed, housed, fully assembled, ready to lock on the shaft

Delivered from stock in 4 basic types and a vast range of sizes

"DODGE-TIMKEN" MEANS QUALITY!

100-TON PULL

Three Dodge-Timken Pillow Blocks carry the load of a 100-ton pull of castings in and out of a shot blast chamber for the Falk Corporation, at Milwaukee. The bearings save the gear reducer from side pull and allow the shaft to turn easily even while taking the full load. Perfect operation for 8 years to date.

It was Dodge who took the famous Timken Bearing, mounted it, sealed it, housed it and delivered a pillow block of new high quality—fully assembled, ready to lock on the shaft and carry the power loads of industry with new efficiency.

Power savings, improved machine operation, reduced maintenance, elimination of spoilage and steadier production—all result so regularly from the application of Dodge-Timken Bearings that this great line is widely accepted as the standard for comparison in up-to-date power transmission layouts.

Ask the Transmissioneer, your local Dodge Distributor, how these bearings and other Dodge "firsts" can help you achieve better, more economical production.

DODGE MANUFACTURING CORPORATION, MISHAWAKA, IND.

OTHER DODGE "FIRSTS"

TAPER-LOCK V-BELT SHEAVES. Easy on—easy off—hold fast to shaft.

ROLLING GRIP CLUTCH. No toggle! Flexibility. Positive drive.

"SC" BALL BEARING Pillow Block with new Neoprene metallic-backed seal.

DODGE of Mishawaka, Ind.

CALL THE TRANSMISSIONEER. Look for the name of the Transmissioneer, your local Dodge distributor, under "Power Transmission Equipment" in your classified telephone directory.

NAME PLATES

FOR YOUR NAME PLATE REQUIREMENTS, WRITE OUR SUBSIDIARY, ETCHING COMPANY OF AMERICA, 1520 MONTANA STREET, CHICAGO 14, ILLINOIS

Oakland. Robert E Sexmith will be West Coast manager, fire extinguisher div, located in Los Angeles.

Warren M Pike, 274 Franklin St, Boston, Mass., represents **Farrel-Birmingham Co** in New England.

Additions to executive personnel of Pesco Products div, **Borg-Warner Corp,** Cleveland, are as follows: John A Lauck—vice-president; D A Sutherland—industrial relations manager; G V Patrick—Eastern sales manager for industrial products. Pesco's entire manufacturing and research equipment is to be moved to the new site in Bedford Township, Ohio.

Frederic Flader Inc, North Tonawanda, N. Y., names Dr Victor B Corey to succeed Carl L Frederick as manager of engineering physics div.

Charles Moeller is now district sales engineer in Kansas City office of **Chain Belt Co.**

Laclede-Christy Co, St. Louis, Mo., elects Albert B Agnew vice-president-in-charge of operations of all plants of Laclede-Christy and subsidiary companies.

Virginia Welding Co, 114-116 Virginia St, E, Charleston, W. Va., has been chosen distributor for **Hobart Brothers Co** and will cover most of the counties in West Virginia.

Steel Products Engrg Co, Springfield, Ohio, announces appointment of Georges Roudanez as manager of its Combustioneer div.

John S Michie replaces H E Brooks, retired, as works manager of **Reeves Pulley Co,** Columbus, Ind.

National Supply Co, Pittsburgh, Pa., has made Howard W Jordan a director of the company to fill vacancy on the board created by resignation of J H Hillman. Jordan is also chairman of the board of Metropolitan Sand & Gravel Corp. Port Washington, N. Y.

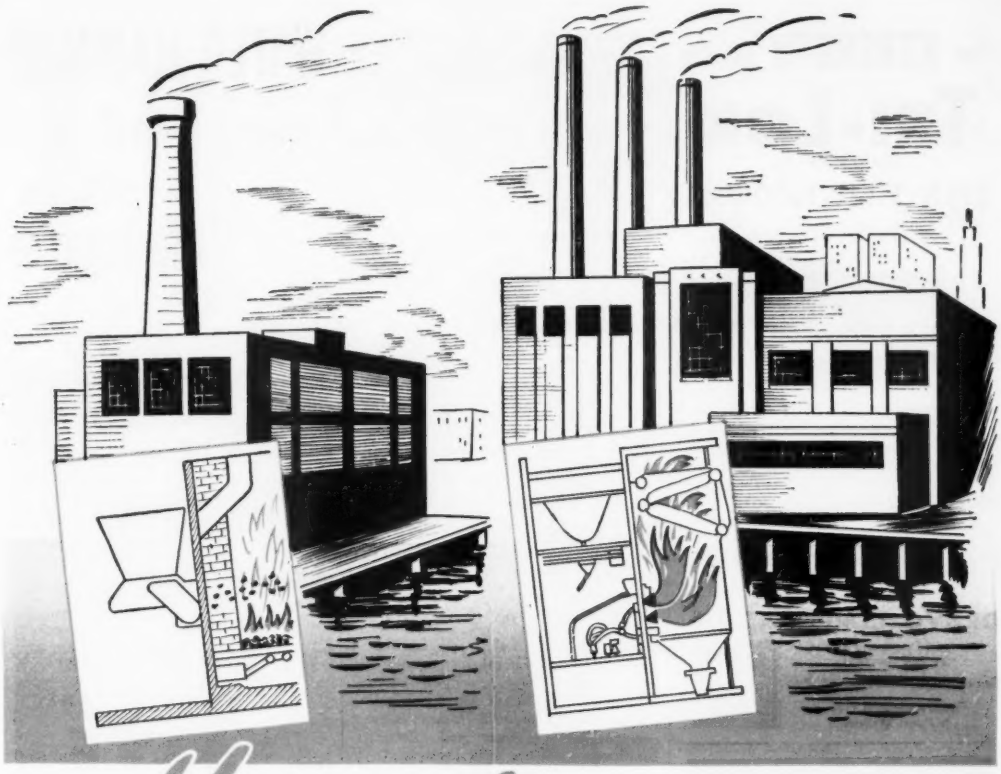
John C Ringland and John D Colombo have been named district engineer and field representative, respectively, in Detroit div of **Sylvania Electric Products Inc.**

Ward Leonard Electric Co selects Central Station Engrg Co, 2817 Croyden Dr, Tucson, Ariz., as sales representative in the state of Arizona.

Ralph S McNair becomes superintendent of power at the Electro Metallurgical div of **Union Carbide & Carbon Corp's** new plant in Ashtabula, Ohio.

Carboloy Co Inc has chosen Pye-Barker Supply Co, 231 Pryor St, S W, Atlanta, Ga. as its authorized distributor in Atlanta and northern counties of Georgia.

W G Twyman of **A P Green Fire Brick Co,** Mexico, Mo., is being transferred to Detroit Mich., to become general manager of A P Green Fire Brick Co of Michigan, a



Versatile is the WORD for OHIO COALS

when complemented by good plant design!

Both of these plants can economically use a wide variety of coals owing to conservative design. Here are their fuel specifications:

FOR AVERAGE MARKET CONDITIONS		BASIS FOR DESIGN
1½" x 0" to ⅜" x 0"	SIZE	1½" x 0" to ⅜" x 0"
6.0	MOISTURE	12.0
10.0	ASH	15.0
3.5	SULPHUR	4.5
2050	ASH SOFTENING TEMPERATURE	1900
12500	B.T.U.	11.000
55	GRINDABILITY (HARDGROVE)	45

Write Us For More Information on How to Conduct A Fuel Investigation.

OHIO COAL ASSOCIATION

ROCKEFELLER BUILDING • CLEVELAND 13, OHIO

For STRENGTH specify

TRI-LOK

RECTANGULAR

OPEN STEEL FLOORING

The locked-in strength of Tri-Lok enables it to stand up under heavy loads—even on long spans. No rivets, bolts, or welds are used in the construction of Tri-Lok; this feature eliminates the possibility of loose joints.

Tri-Lok is also available in Diagonal, or Super-Safety U-type Flooring, and in Stair Treads of all types. Write for Bulletin KM 1140.

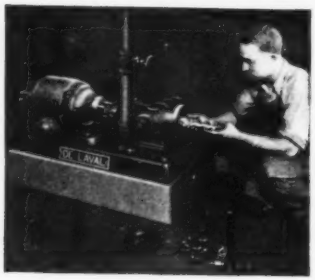
DRAVO CORPORATION

National Distributor for the Tri-Lok Company

Dravo Bldg., Pittsburgh 22, Pa.

Sales Representatives in Principal Cities

DRAVO



DE LAVAL-IMO PUMPS

SIMPLE . . . RELIABLE . . . EASY TO TAKE APART

Only three moving parts. No pilot gears. No sliding vanes. No reciprocating members. Nothing to get out of order.

IMO Pumps are designed for handling oils, hydraulic control fluids and other liquids over a wide viscosity range.

IMO

Send for Catalog L-32AP

1-155

IMO PUMP DIVISION of the

DE LAVAL STEAM TURBINE CO.

TRENTON 2, NEW JERSEY

subsidiary selling firm covering the state of Michigan. Twyman is being replaced by W F Mundy as production manager in Mexico, Mo.

J M Davies is appointed director of research of **Caterpillar Tractor Co.** Peoria, Ill., following C G A Rosen's departure because of ill health. Dr L A Blanc succeeds Davies as associate director.

E L Dennis Engrg Co, New Orleans, La., has expanded its facilities to include complete engineering services to refineries, natural gasoline plants, chemical plants and allied industries. This activity has been consolidated under the Process div of the organization. Lawrence E Skelly, formerly of Stone & Webster Engrg Co, will be in charge.

R J Rutherford assumes position of assistant chief engineer of the Avon Park plant of **Florida Power Corp.**

Several changes in **West Penn Power** managerships are as follows: E D Miller is promoted to Eastern div manager, with headquarters at Greensburg. He replaces L F Blassingham, who resigned. M L Bouch succeeds Miller as district manager at Greensburg. R C McMahon transfers from Springdale to take over former duties of Bouch as Latrobe-Ligonier district manager. K E Rupert, New Kensington district manager, assumes additional responsibility of Springdale district, which will be combined with New Kensington for operating purposes. Also, Gordon B Hoffman is made company civil engineer and George L Braithwaite, assistant civil engineer. C W Kenney, construction engineer for the company, is retired.

Texas Power & Light Co has named John W Carpenter chairman of the board; W W Lynch, president and general manager; and Lee E Cook, vice-president and assistant general manager. New directors are E L Ashcroft Jr, Sulphur Springs, and Lee Cook.

Dr J C Warner, dean of graduate studies and head of chemistry dept at **Carnegie Institute of Technology,** becomes president-elect to succeed Dr Robert E Doherty, who will retire as Carnegie's president next year. Warner will fill a newly-created office of vice-president until his inauguration after Doherty's retirement, July 1, 1950.

Raymond J Bros, president and treasurer of Wm Bros Boiler & Mfg Co, Minneapolis, has been re-elected for a second term as president of **American Boiler Manufacturers Assn.**

Sidney Sussman has become associated with **Water Service Labs Inc,** New York, N. Y., as chief chemist.

American Institute of Electrical Engineers elects following officers: *President*—James F Fairman, vice-president, Consolidated Edison Co of N. Y.; *vice-presidents*—C G Veinott, Lima, Ohio; W J Seeley, Durham, N. C.; W C DuVall, Boulder, Colo.; Ralph A Hopkins, Los Angeles, Calif.; A H Frampton, St. Catherines, Ont., Canada; directors—E W Davis,

WATER HAMMER

can cost

a Fortune

yet it costs so little to correct with

THE WILLIAMS-HAGER *flanged* SILENT CHECK

VALVE

Used and specified on hundreds of new buildings—and installed on thousands of old buildings to prevent costly "Water Hammer"—the Williams-Hager Flanged Silent Check Valve will solve your problem, too! Write for new technical bulletin.

THE WILLIAMS GAUGE CO.

Pump Valves . . . Water Gauges . . . Gauge Cocks . . . Steam Traps . . . Pump Governors . . . Feed Water Regulators . . . Water Columns

2055 PENNSYLVANIA AVE. · PITTSBURGH (12), PA.

No Clinkers ... CONTINUOUS

... MONTHS ON THE LINE

Bernitz air-cooled "Carbofrax" piers with Bernitz S-100 air-cooled "Carbofrax" blocks on furnace sidewalls cut maintenance to nothing for this well-known manufacturer.

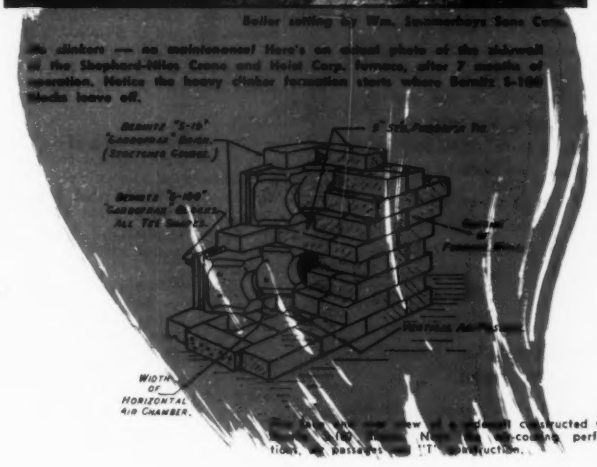
... reports Shephard-Niles Crane and Hoist Corporation Montour Falls, New York

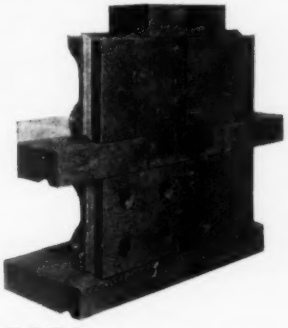
With down time getting higher and load requirements not being met, Shephard-Niles last year revamped its furnace by installing a modern spreader stoker equipped with Bernitz air-cooled "Carbofrax" piers and sidewalls of Bernitz "Carbofrax" S-100 blocks. This Spring, after operating the new installation for 7 continuous months at an average rating of 175% and peaks of 200%, the Bernitz piers and S-100 Sidewall Blocks were inspected and found as sound as the day they were installed . . . no clinker formation . . . no pier or block destruction . . . no penetration . . . maintenance cost for the period: **0**

You can get performance like this in your furnace—but *only by specifying Bernitz constructions*, for only Bernitz Shapes give you these two all-important, cost-cutting advantages: 1. They're made from "Carbofrax"*—tough, heat and abrasion resisting silicon carbide. 2. Exclusive air-cooled construction keeps walls clinker-free.

Write or call your nearest Bernitz representative today for complete details.

*"Carbofrax" is the registered trade mark of, and indicates manufacture by, the Carborundum Co.





OTHER BERNITZ PRODUCTS

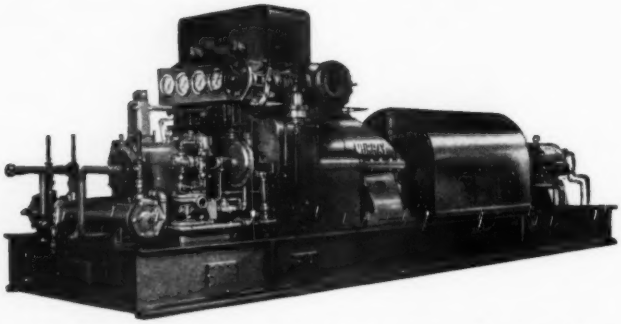
Bernitz Air-Cooled Furnace Lining • Bernitz Air-Cooled Floors • Bernitz-Nygaard Water Wall Blocks for Walls and Arches
Bernitz Super-Generator Linings For Water Gas Sets

BERNITZ "CARBOFRAX PIERS"

BERNITZ FURNACE APPLIANCE CO.
89 BROAD STREET, BOSTON 10, MASS.
NEW YORK — PHILADELPHIA — SYRACUSE — ATLANTA — PITTSBURGH — CLEVELAND — CINCINNATI — DETROIT — CHICAGO — INDIANAPOLIS — MINNEAPOLIS — KANSAS CITY — RENO MONTREAL — TORONTO — WINNIPEG

MURRAY

TYPE D TURBO-GENERATOR



Murray Type D turbo-generators are built in a capacity range from 500-3000 KW. Turbines are either direct-connected to 2-pole generators or operate through reduction gears connected to 6-pole generators at 1200 RPM. Direct current and 25 cycle machines are also available. This type machine is regularly furnished in the above capacity range either condensing or non-condensing and may be of the automatic extraction type or for high back pressure. Units may be mounted either on soleplates or on a fabricated steel base.

This type turbo-generator is designed to operate on steam conditions up to 600#, 750° F. TT. Auxiliary equipment normally includes combined trip throttle valve, complete pressure lubrication system including oil tank, oil filter, coolers, and automatic turbine-driven auxiliary oil pump. Gauge board with gauges, vibrating reed tachometer and necessary thermometers are also furnished.

The above photograph shows a machine of this type rated at 1000 KW. Two duplicate machines are installed in our Nation's Capitol.

Murray turbo-generators have long been noted for their rugged construction, operating economy and long life with a minimum of maintenance.

WRITE TODAY FOR FULL DETAILS

MURRAY IRON WORKS COMPANY
BURLINGTON, IOWA

BUILDERS OF STEAM POWER EQUIPMENT
FOR THREE QUARTERS OF A CENTURY

Cambridge, Mass.; N B Hinson, Los Angeles, Calif.; H J Scholz, Birmingham, Ala.; *treasurer*—W I Slichter, New York, N. Y. (re-election). These officers, together with the hold-over officers, will constitute the board of directors for the next administrative year beginning Aug. 1, 1949.

OBITUARIES

J D Berg, 66, chief executive officer and a director of Dravo Corp died suddenly, June 29, in his home in Chatham, Cape Cod, Mass.

Anderson W Harris, 66, in charge of firetube boiler and fabricated product sales at the Chattanooga div of Combustion Engrg—Superheater Inc, died suddenly, June 2, from a heart attack.

J Frederic Byers Sr, chairman of the board of A M Byers, Pittsburgh, died June 11 in Roosevelt Hospital, New York City.

Edwin J Ostermeier, president of Apex Engrg Co and Delta Engrg Co, died June 8.

Lake Shore Engrg Co, Iron Mountain, Mich., has announced formation of a conveyor div of the company to manufacture and sell *Tote-All* and *Coaltoter* lightweight, power-driven portable belt conveyors for handling bulk and packaged materials. These machines were formerly manufactured by Material Movement Industries, Inc, Skokie, Ill. Horton Conrad, president of Material Movement Industries, who has been appointed to direct sales of the new conveyor div, states Material Movement Industries, Inc, will be dissolved. The Material Movement Industries dealer organization will continue to handle Tote-All and Coaltoter conveyors for Lake Shore Engrg Co.

The 32nd annual meeting of the Stoker Manufacturers Assn, national organization of manufacturers of automatic coal-burning equipment, was held at French Lick, Ind., on June 13 and 14, with 100 officials and representatives of prominent stoker manufacturing, supply and allied firms in attendance.

The following were elected directors of the association for the ensuing year: (1) Claude A Potts (2) C T Burg (3) C P Meredith (4) L C Dubs, Canton, Ohio, president, Canton Stoker Corp (5) Edward M Clifford, New Albany, Ind., manager, anchor div, Stratton and Terstegge Co (6) George W Graham, Chicago, president, Eddy Stoker Corp (7) Frank Hoke, Indianapolis, Ind., president, Holcomb & Hoke Mfg Co (8) J M McClintock, Chicago, manager, stoker div, Illinois Iron and Bolt Co (9) Walter Sormane, Mendota, Ill., sales manager, Conco Engrg Works.

The third annual technical conference, sponsored and conducted by the association's engineering and research committee headed by Joseph G Beard, Illinois Iron and Bolt Co, was held in conjunction with the convention. The theme of this technical conference was smoke abatement and air pollution.

DeLaval OIL PURIFIERS

CLEAN THE FUEL-- PROTECT THE ENGINES

De Laval Oil Purifiers at Tacubaya will remove by centrifugal force any dirt or other solids that may get into the stored fuel oil in spite of all precautions. They will restore the oil to the clean condition necessary to best engine performance. They will remove the impurities that could cause excessive abrasion and wear on cylinder liners and piston rings . . . they will assure maximum economy of fuel supply.

De Laval Oil Purifiers are available in a number of sizes to handle a wide range of capacity requirements, and as either a Purifier alone or as the "Uni-Matic," complete with integral pumps and, if desired, with heaters.

DeLaval

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

OIL PURIFIERS
for Lubricating and Fuel Oil

"GUNITE" Concrete
(SINCE 1915)
Linings for
STEEL BUNKERS •
DUCTS, HOPPERS •
STACKS •
UPTAKES •
BREECHINGS •
• • •
STEEL & PIPE ENCASEMENT
• • •
FIREPROOFING •
GUNITE CONCRETE & CONST. CO.
1301 Woodswether Road
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R. N. Turner, Dist. Mgr., 228 No. La Salle St., Chicago 1, Ill. B. H. Mueller, Distr. Mgr., 6625 Delmar Blvd., University City, (St. Louis), Mo. Philip D. Barnard, Distr. Mgr., 2036 Addison, Houston 5, Tex.
Branch Offices: New Orleans, Dallas, Denver.
"See our catalog in Sweet's"

EISLER TRANSFORMERS
STANDARD & SPECIAL
From ¼ to 400 KVA up to 15,000 volts
We manufacture a complete line of:
*AIR, OIL OR WATER-COOLED DISTRIBUTION TRANSFORMERS
*Special Designs available to meet Customers Specific Requirements
TRANSFORMERS FOR
*ELECTRIC FURNACES
*WELDING
*HEATING
*PHASE CHANGING
Etc.
POWER & LIGHT TRANSFORMERS
For isolation of Light from Power, or Light from Telephone
EISLER TRANSFORMERS are manufactured strictly to Standards of the N.E.M.A., A.S.A., and A.I.E.E.
WRITE FOR SPECIAL CATALOG
EISLER ENGINEERING CO., INC.
Chas. Eisler, Pres.
757 South 13th Street, Newark 3, N. J.

CATAWISSA Unions give you a PERFECT SEAL
even when the pipe is not in perfect alignment!
● HOT FORGED STEEL
● STAINLESS STEEL
Seats in all Catawissa Unions are a 55° angle on the female end to a BALL on the male end —assuring good, tight, leakproof joints!
Made in STANDARD and DOUBLE EXTRA HEAVY types to meet specific pressure requirements!
Double Extra Heavy Hot Forged Steel SWING CHECK VALVES
write for your copy of BULLETIN 10-A
CATAWISSA VALVE & FITTINGS CO.
206 Mill St. • CATAWISSA, PA.

NEW EQUIPMENT

(Continued from page 182)

250 ac or dc as specified. Audible signal is a 3-in. heavy-duty bell—or horn, if desired—for external mounting.

Auth Electric Co, 34-20 45th St, Long Island City, N. Y.

P765 • CHAIN REPAIR—Special tool combining an anvil, fork and punch easily disassembles roller chains, formerly an involved maintenance job.

The drive-fit of pins into the roller-chain sideplates meant driving out a pin link first. The new tool inserts the prongs of the fork between the chain sideplates so as to span the two rollers containing the drive-fit pins. Both fork and chain are then laid in the slot of the anvil that is milled to chain contour to prevent slippage. With the chain suspended on the fork a sharp blow on each pin drives it free of the links.

Atlas Chain And Mfg Co, Castor And Kensington Ave, Philadelphia 24, Pa.

P762 • ELECTRODE HOLDER—Six new electrode holders have been announced, five for manual welding in 100-, 200-, 400-, and 800-amp ratings and one for machine welding in ratings of 400- and 800-amp.

Manual welding holders feature: (1) for the 100-amp rating an air-cooled model with spring-type collets, metal nozzle and gas-tight heat-resistant gasket (2) for the 200- and 400-amp sizes, water cooled models with split copper collets, ceramic nozzles and gas-tight, heat-resistant gaskets (3) for the 400-amp one an integral water-cooled metal nozzle with tips of two orifice diameters (4) in the 800-amp model one electrode assembly for each listed size and with three watercooled metal nozzles, one for 5/16- and 3/8-in. electrodes, one for 7/16-in. and one for 1/2-in. electrodes.

For machine welding the new 400-amp watercooled electrode holder comes furnished with one piece of each size of tungsten and one set of collets for each size. The 800-amp watercooled holder has one electrode assembly and nozzle for each size electrode. The electrode extension may be adjusted while welding.

General Electric Co, Schenectady 5, N. Y.

COPPER ALLOY BULLETIN

MARINE AND POWER EDITION

REPORTING NEWS AND TECHNICAL DEVELOPMENTS OF COPPER AND COPPER-BASE ALLOYS

Prepared by BRIDGEPORT BRASS COMPANY "Bridgeport" BRASS CO. *Headquarters for BRASS, BRONZE and COPPER*

Are Condenser Tubes Being Injured in Storage?

Careful Handling and Good Storage Recommended to Prevent Deterioration

What happens to condenser tubes after they leave the mill? Do they receive the consideration they deserve as essential components of surface condensers and various types of heat exchangers?

Condenser Tubes Are Carefully Made

It should be emphasized that the mill considers condenser tubes as a highly specialized product. They are carefully made from special corrosion resisting alloys. Close attention is given to meet the exacting specifications as to composition, gauge, grain size, surface and straightness. Not only does each tube receive a 100% inspection, both inside and outside, but is also subjected to a 1000 pound hydrostatic pressure test to make sure that an imperfect one is not included in a shipment. For protection in handling and in transit, condenser tubes are carefully packed in wooden cases and are expected to arrive at their destination in perfect condition.

Dangers From Improper Handling and Storage

Fortunately, most operators treat condenser tubes as carefully as they do other essential supplies or equipment. However, since power plants, petroleum refineries, and chemical plants generally carry stocks of spare tubes for replacement or for retubing heat exchangers, there is danger of deterioration through improper handling and unsatisfactory storage conditions.

Improper handling may result in dents, digs, kinks, or a permanent set which predispose the tubing to premature failure.

Storage in damp warehouses, subject to a wide range of temperatures, is undesirable. Setting cases of tubing on wet floors or wet ground should be avoided because they absorb and retain moisture. Green copper salts form on tubes in contact with the wet walls of wooden cases. Condensation of moisture leads to surface corrosion with the formation of brown, black, green and other colored film or corrosion products.

Outdoor storage of tubes is generally very undesirable. It may lead to accumulation of dust, cinders and soot, which, together with condensation and moisture produce serious corrosion on the outside surface of the tubing. Covering with a tarpaulin, unless arranged to permit free circulation of air, may retain dampness. The combined action of high humidity and certain contaminants in the atmosphere may produce season cracking, especially if the storage period is extended.

Recommendations

Treat condenser tubes with care. They can be injured with resulting lower service life.

1. Keep tubes in cases, flat until ready for use—but don't stack too high to avoid crushing of bottom cases.

2. Select a dry, protected storage location not subject to extremes of humidity and temperature.

3. Avoid outdoor storage especially where there is dirt, smoke, soot and corrosive fumes.

4. If cases become watersoaked, both the cases and tubes should be promptly dried out.

5. When ready to use, remove tubes from cases carefully.

6. If stored in racks, tubes should be properly supported.

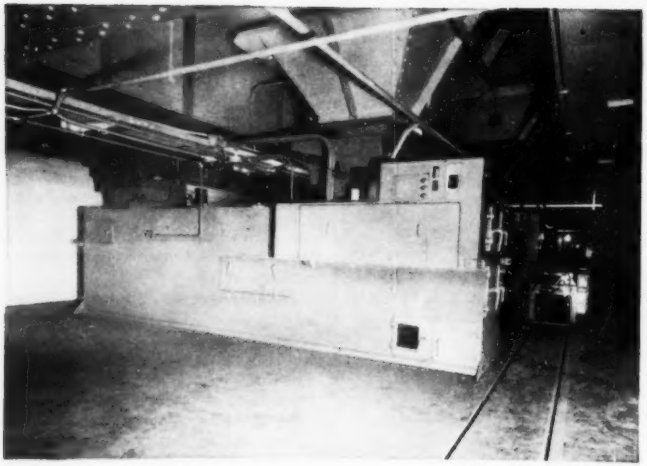
Corrosion Problems

Corrosion is a constant menace to the life of condenser and heat exchanger tubing. Much has been learned of the characteristics of various alloys. There is still much to learn on this subject. Much help is coming in from operators all over the country who share their experience on the behavior of various alloys under actual operating conditions. Bridgeport's Corrosion Laboratory appreciates this fine cooperation and is anxious to be of service to condenser and heat exchanger users.

BRIDGEPORT BRASS

BRIDGEPORT BRASS COMPANY, BRIDGEPORT 2, CONN. • *ESTABLISHED 1865*

Mills at Bridgeport, Connecticut, and Indianapolis, Indiana • In Canada: Noranda Copper and Brass Limited, Montreal



SEWAREN
KEYNOTES EFFICIENCY

RICHARDSON
DENOTES COMPLIANCE

Efficiency and simplicity keynoted the design and construction of Public Service Electric and Gas Company's new, 450,000 kw. Sewaren Generating Station. To keep building and operating costs down, four semi-outdoor type boilers supply steam at 1050° F., the highest temperature to be utilized commercially. To keep tab on coal consumption, 12 self-testing, elongated type, Richardson Automatic Coal Scales were installed.

An 1800-ton bunker supplies coal for each boiler. Four of the 12 Richardson Scales weigh and feed coal to three pulverizers, each of which is fed from either of two scales. When required, coal can be by-passed through a motor operated gate direct to the pulverizer or to a shuttle conveyor for delivery to adjacent boilers. Dust-proof construction of scales withstands pressure equal to 40 inches of water, confines coal dust to scale housing, contributes substantially to cleanliness of the plant.

For over 40 years Richardson Automatic Coal Scales have been helping central stations and industrials eliminate preventable coal waste and produce more power at less cost . . . a good reason for calling on Richardson when you plan to modernize your present plant or build a new one.

5867

For further details on Richardson Coal Scales, write for Bulletin 1143-P.

RICHARDSON
SCALE COMPANY, Clifton, N. J.
ATLANTA • BOSTON • BUFFALO • CHICAGO • MINNEAPOLIS • WICHITA
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McGRAW-HILL PUBLICATIONS

How TIMKEN® bearings keep a prime mover in its prime

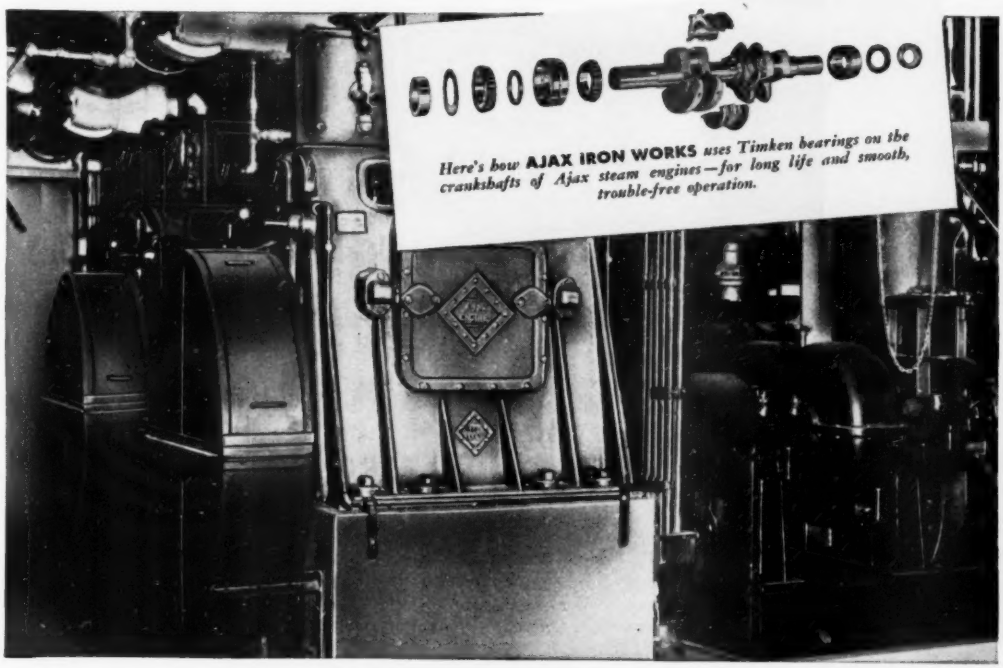
DESIGNED as a compact, economical prime mover for general industrial use, the Ajax 2-cylinder vertical steam engine maintains its high efficiency throughout years of trouble-free operation. One reason for this is the use of Timken® tapered roller bearings on the crankshaft.

Timken bearings hold the crankshaft in accurate alignment. Their tapered construction carries both radial and thrust loads. By helping to prevent crankshaft deflection and end-play, Timken bearings assure long life and smooth operation of reciprocating parts. The line contact between the bearing rolls and races gives the crankshaft maximum support and provides tremendous load carrying capacity to take the severe pull of output drives.

Timken bearings in this engine simplify lubrication problems. And their true rolling motion and incredibly smooth surface finish practically eliminate friction and wear.

Timken bearings are made of the best steel ever developed for tapered roller bearings—Timken fine alloy steel. For fine bearing performance throughout the life of the machine, specify Timken bearings on all the equipment you make or use. Look for the trade-mark "Timken" on the bearings. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



Here's how **AJAX IRON WORKS** *uses Timken bearings on the crankshafts of Ajax steam engines—for long life and smooth, trouble-free operation.*

NEW TIMKEN BEARING CUTS RUN-OUT IN HALF!

Until now, the Timken "Zero" bearing has been the last word in bearing accuracy. Now Timken offers industry the "Double-Zero" bearing—*twice as accurate* as the "Zero"! Maximum run-out of the new "Double-Zero" bearing is only 75 millionths of an inch—*half* the 150 millionths run-out of the "Zero" bearing.

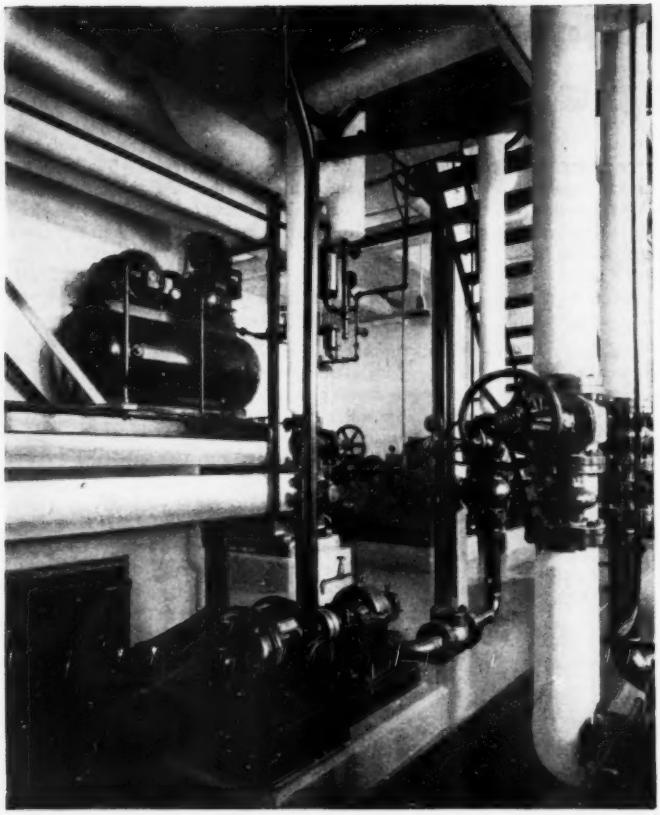
What an opportunity for manufacturers of machines where extreme accuracy is essential! Available in standard single row types, up to 10" O.D. Write for further information.

TIMKEN

TAPERED ROLLER BEARINGS

TIMKEN 1899 50 1949 YEARS

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▱ BEARING TAKES RADIAL ◫ AND THRUST ◫ LOADS OR ANY COMBINATION



Pratt & Whitney's 14-mile K&M insulation starts here. It's fit for the job and looks fit!

Where K&M "*Featherweight*"® 85% Magnesia

Keeps up steam...keeps down cost...for 14 miles

Pratt & Whitney Division of Niles-Bement-Pond Company, West Hartford, Conn., has long been noted for fine machine tool, cutting tool and precision gauge manufacture. The scientific attitude is a Pratt & Whitney habit. They applied it to saving b. t. u.'s along 14 miles of steam lines throughout their large power plant and shops. That led them to use K&M "Featherweight" 85% Magnesia pipe insulation for maximum efficiency and permanence.

The inherent insulation effectiveness of K&M "Featherweight" 85% Magnesia comes from basic Carbonate of Magnesia. This is combined with clean Asbestos Fibre in correct proportion for needed weight-saving strength. Therefore it is easy to do a fast, shipshape insulation job whose continued efficiency does not depend on costly maintenance.

Designed for temperatures to 600° F., K&M "Featherweight" 85% Magnesia comes in all standard sizes. Like the other K&M insulation materials, it can save you waste—difficulty—money. Get help on any points by consulting your nearest K&M Distributor—an insulation expert.

Nature made Asbestos...

Keasbey & Mattison has made it serve mankind since 1873

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Nearly every plant has need for a bucket elevator—lifting material up into the air so that something else may be done with it. A certain height — certain capacity — certain results. There is a bucket elevator in the broad Jeffrey line to do that job to your complete satisfaction. Standards have been worked out—to save you time—to save you expense in making layouts. Complete drawings to suit each particular elevator. We will go into detail.

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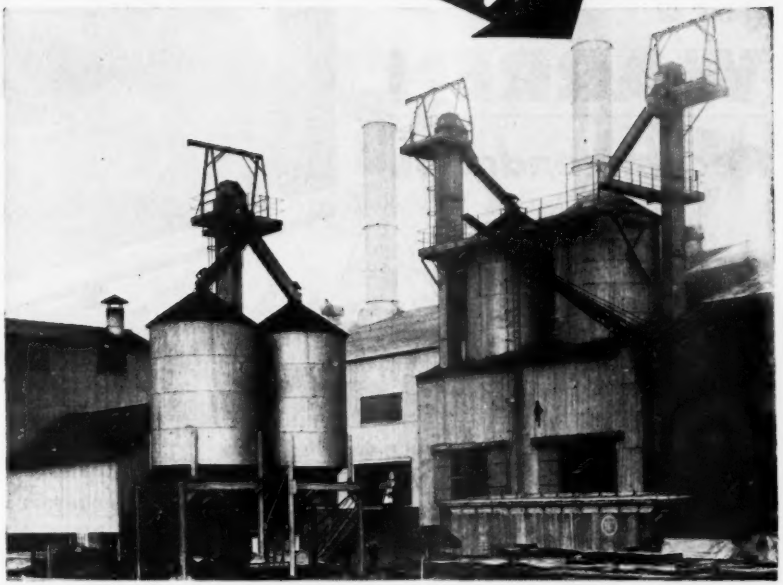

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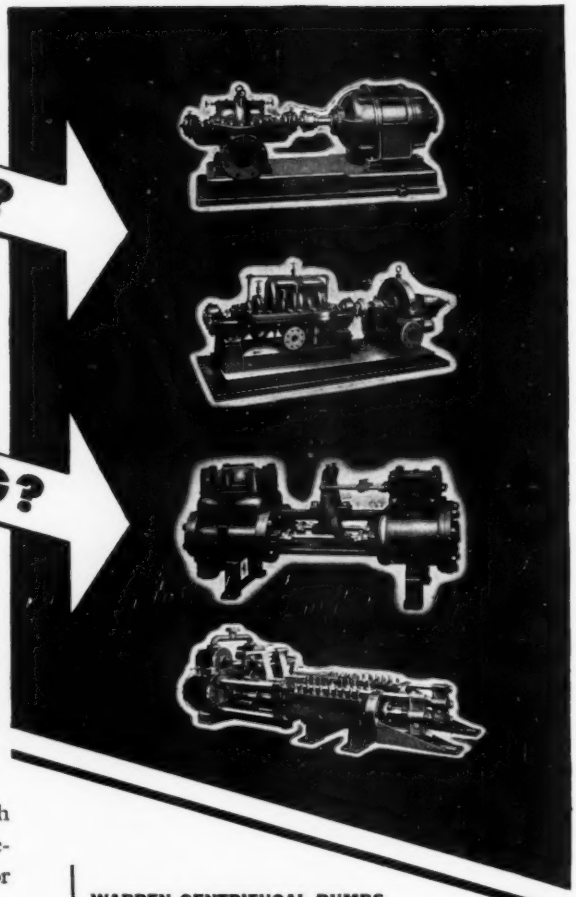
RECIPROCATING?



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Warren makes a wide range of both types of pumps. And if you have a special problem that needs a special pump or application, Warren will engineer it for you.

Long, highly specialized experience as pump makers *exclusively* is at your disposal. Put your problem up to Warren. Every possible step will be taken to justify your confidence.

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WARREN CENTRIFUGAL PUMPS

Single and multi-stage
Pressure range: 0 to 1200 P. S. I.
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Types: Horizontal and Vertical
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Costly plug cleaning, with its high labor bills and lengthy equipment down-time, goes out of the condenser and heat exchange picture the minute chlorination arrives.

This proven process for cutting the costly effects of back pressure and poor heat transfer characteristics caused by slime, really works, as one Southern Power Station found out when they began using the W&T De-sliming Process. In just six months after W&T Chlorinators were installed, cleaning and excess steam costs were reduced from $1450 per month to $250 per month and a later survey showed an overall saving in excess steam costs of $16000 in a year.

Such savings are indicative of how your condensers may be made to operate more economically and with far less outage when W&T Engineers install chlorination to fight your slime problems.

To learn how chlorination may be profitably applied to your heat exchange equipment and to take advantage of W&T's 35 years' experience, write today.

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CHLORINE AND CHEMICAL CONTROL EQUIPMENT
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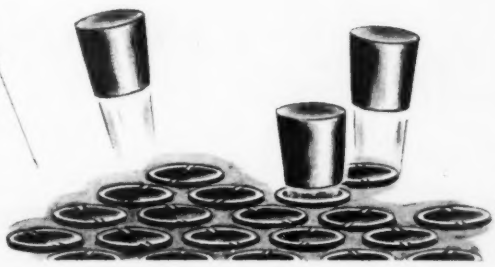

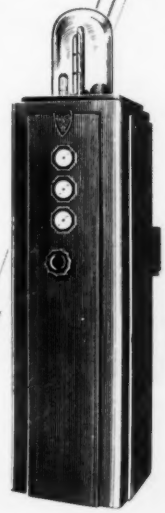

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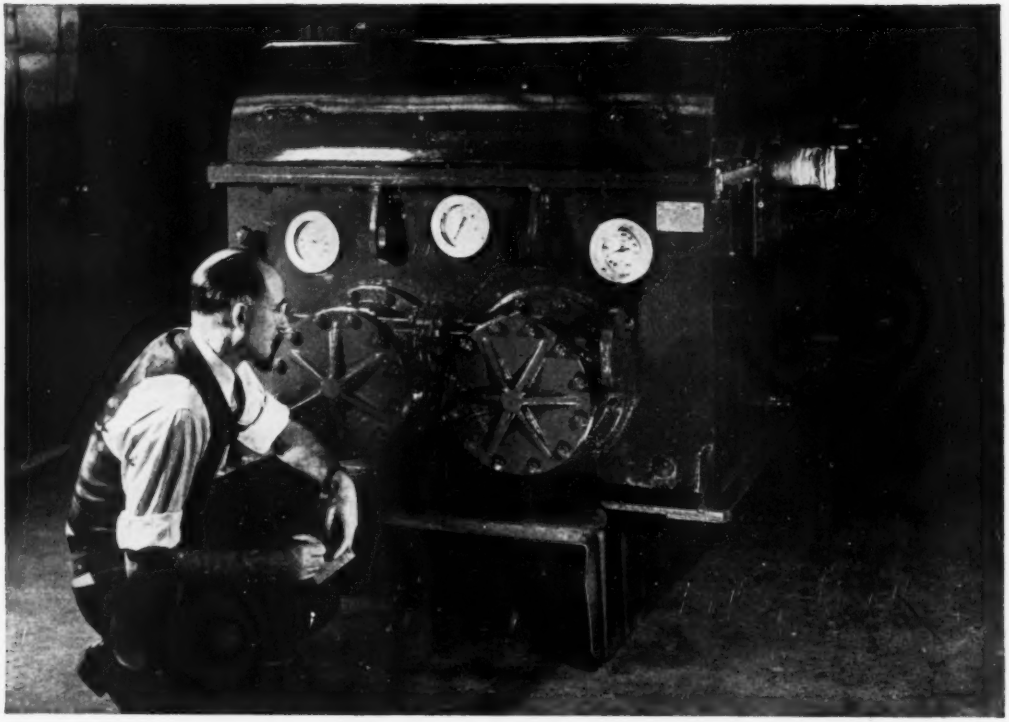

That's our "baby"!

We're not referring to "Mac" Stephens, veteran of 21 years with American Blower (18 years' experience in building Gŷrol Fluid Drives), although we're mighty proud of him.

The object of our affection is the Gŷrol Fluid Drive for a Boiler Feed Pump, purchased by the Cameron Pump Division of Ingersoll Rand Company for a large midwest utility, which "Mac" is admiring as he gives it a final check.

You see, Gŷrol Fluid Drives for Boiler Feed Pumps, are the latest addition to the American Blower line of power plant equipment. They have won a wide reputation in public utilities and elsewhere as a better, more effective and efficient means of adjustable speed control for Boiler Feed Pumps.

An American Blower sales engineer will be glad to furnish you with complete data on the application of American Blower products for your plant. You will find him just as experienced in his work as "Mac" Stephens is in the manufacturing end of the business.

Whether you require Gŷrol Fluid Drives for Boiler Feed Pumps or Fan Control, or American Blower Mechanical Draft Equipment and Fly Ash Precipitators, you can benefit by his experience. Phone him today. There is no obligation.

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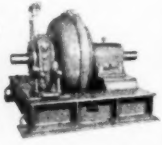
HS and Sirocco Fans for forced or induced draft in all types of power plants.

ST Fly Ash Precipitators—especially for power plants burning pulverized fuel.



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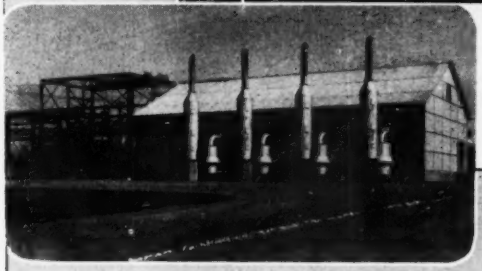

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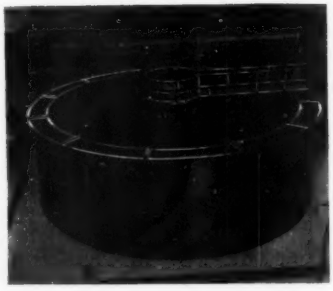
STOP WASTING "WASTE" WATER

USE IT FOR BOILER FEED OR COOLING

You are pouring dollars down the sewer when you fail to reclaim "waste" water that might otherwise be used over and over again. In most cases this so-called "waste" water can be used as boiler feed or for cooling with a drastic reduction in your water bill and a simplification of your disposal problem.

Let Graver analyze your "waste" water problem today. Let Graver show you how the Reactivator (shown at right) will soften and clarify this water to a point where "waste" treatment becomes a profitable operation. Employed in connection with other Graver water conditioning units . . . pressure filters and ion exchange softeners . . . the Reactivator will produce boiler feed and cooling water at lowest possible cost.



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Keep yourself up-to-date on POWER PLANT PIPING

THIS authoritative brochure should be in the hands of every man concerned with the piping requirements of a modern high-pressure, high-temperature steam station. For here is practical data and information that will greatly simplify your selection and use of power piping and will help you obtain greater efficiency and better results from its application.

In the 30-page "Technical Section" of this book you will find valuable information (some not hitherto published) on working stresses, creep properties, pipe bends; on weights, dimensions, properties of pipe and tubes and similar important data that you can use to excellent advantage.

Our Piping Specialists have cooperated in the construction of some of the Nation's most efficient light and power plants. Their experienced assistance is always at your service.

No coupon required — just ask for a copy of Bulletin 10—*Power Plant Piping.*

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UNITED STATES STEEL

How Darling Cast Steel Gate Valves

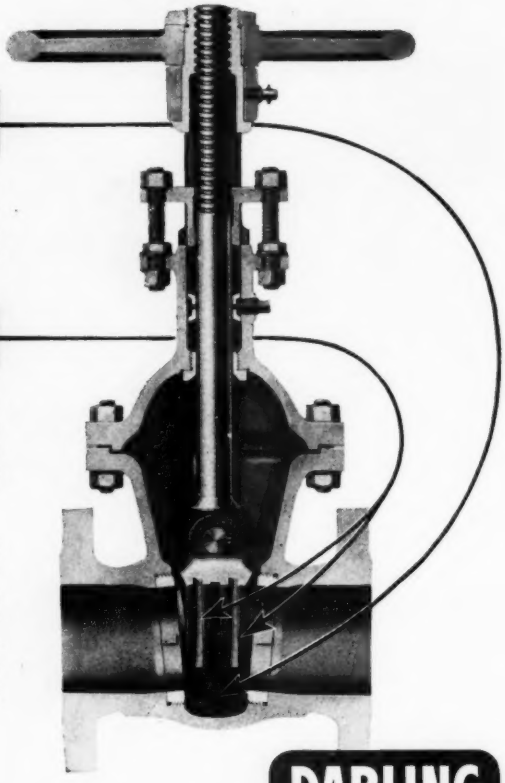
AVOID TROUBLE
REDUCE MAINTENANCE

SLOTTED WEDGE

Allows compression of the wedge. Compensates for valve body expansion or contraction due to temperature changes. Thus tight closing and easy opening are assured, with far less wear and tear on wedge faces and seats.

DOUBLE-GROOVED WEDGE

Double grooves, with corresponding twin ribs in valve body, provide twice the usual bearing area for lasting, trouble-free alignment. Eliminates wedge canting, due to line pressure, preventing damage to downstream seat.



These are only two of the many "ounces of prevention" built into Darling valves. They always add up to gate valve performance at its low-cost best! Give Darlings a chance in *your* service and you'll see for yourself. The 300-page Darling Catalog No. 17M, full of data of general value and description of Darling valves of *all* types, is yours for the asking.

Darling Gate Valves, noted for outstanding quality, strength and precision, are made in a wide range of sizes, types and constructions for all kinds of normal and unusual service . . . and for pressures up to 1500 pounds. In addition to the slotted wedge types, there are solid wedge taper seat valves and the famous Darling Fully Revolving Double Disc Parallel Seat Gate Valves for virtually any service.

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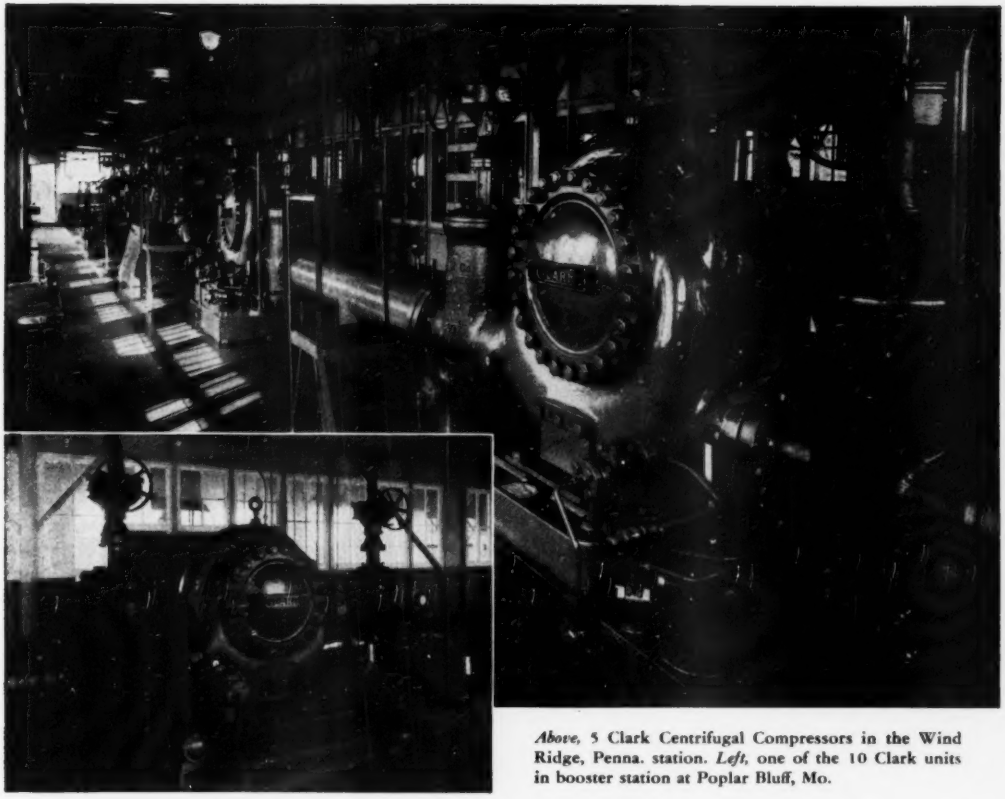
THE VALVE MARK OF QUALITY . . . WATCH FOR IT



Above, 5 Clark Centrifugal Compressors in the Wind Ridge, Penna. station. *Left,* one of the 10 Clark units in booster station at Poplar Bluff, Mo.

CLARK CENTRIFUGALS handle large volumes of gas efficiently ... *DESIGN FEATURES DEPENDABLE SEAL*

Fifteen Clark Centrifugal, single-seal pipe line boosters are handling large volumes of gas at high pressure in the Texas Eastern Transmission Corporation's booster stations at Poplar Bluff, Missouri, and Wind Ridge, Penna.

Reliable performance, quietness of operation and ease of accessibility to internal parts characterize these new Clark units.

Adequate, dependable sealing is achieved by the floating sleeve, oil-film-type seal which is an exclusive Clark feature.

Write us about your compressor requirements.

CLARK BROS. CO., INC. • OLEAN, NEW YORK

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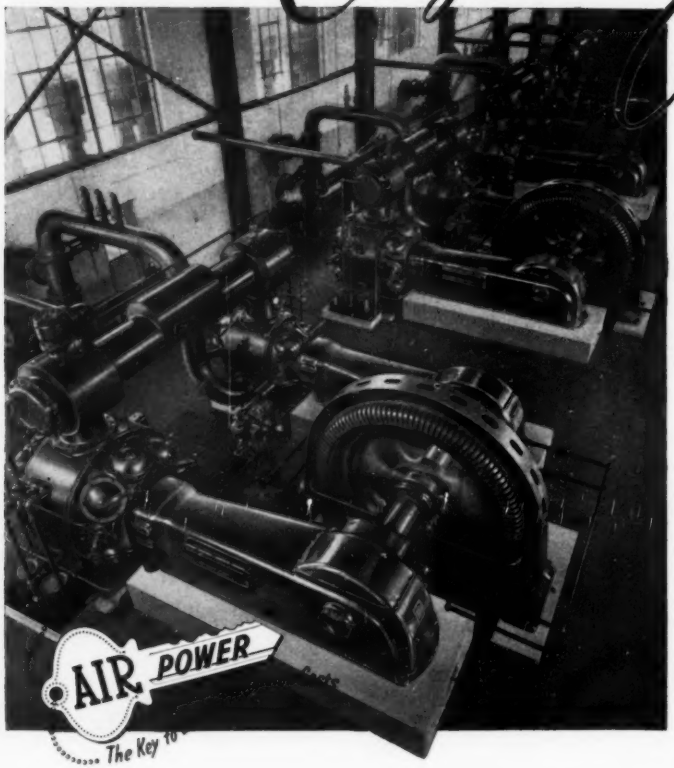
CLARK

ONE OF THE DRESSER INDUSTRIES

Whatever type of Compressor you need, *CLARK MAKES IT*

BACK OF *Every* INGERSOLL-RAND *Compressor* ARE THESE *SupRvalues*



This 2800-horsepower installation of Ingersoll-Rand *Class PRE Compressors* generates the Air Power for one of America's outstanding metal mines. It is typical of thousands of similar heavy-duty compressors that are so essential in practically every industry.

Whether they supply Air Power for Air Tools in factory, mine, or construction work, or compress hazardous gases at extremely high pressure in a costly process, the purchaser must rely upon the experience and judgment of the manufacturer for a dependable compressor that meets his specific requirements. To make sure you get the best, select an Ingersoll-Rand Compressor... backed by *SupRvalues*

Tradition...a 77-year old company that grew from the *two of the earliest* compressor builders in America.

Experience and Know-how to build compressors for *any* pressure, *any* gas, *any* size, *any* service.

Facilities *second to none*... for design, research, metallurgy, and manufacture.

Range of sizes . . . with *standardized* frames, running gears and interchangeable cylinders ... plus *special* cylinders, valves and coolers for special applications.

Flexibility of Drive . . . a *choice* of compressors powered by electric motor, oil, gas, or steam.

Record of Performance ...thousands of compressors successfully operating in *every* branch of industry.

Design Features that give you the best in efficiency, durability, dependability, easy operation, and low maintenance.

Trained Personnel ...men who *know* Air Power...who build, sell, and service air drills and tools as well as compressors.

Progressive Policy...*continuous* pioneering and development of both new and old products.

Service ...with offices in principal cities *all over the world.*

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MILTON Roy

"Packaged" Systems

for BOILER WATER CHEMICAL TREATMENTS

The necessity is well recognized for feeding various chemicals to boilers for the prevention of scale and to control alkalinity, remove dissolved oxygen, protect against embrittlement and insure against corrosion and pitting caused by impurities in the boiler feed water. Practically all competent authorities agree that two distinct methods for conditioning boiler water are necessary.

First, sodium sulfite should be fed continuously to the suction side of the boiler feed pump to react with and remove any residual dissolved oxygen in the boiler feed water. This is necessary because oxygen in the water will act to corrode and pit the boiler feed water pump, economizers and boiler drums and tubes.

Second, other internal treating chemicals should be fed directly into the boiler drums to precipitate incrusting solids, to control alkalinity, and to give a chemical balance in the boiler to prevent corrosion and embrittlement.

Typical Milton Roy "Packaged" Systems for boiler water treatment are illustrated above. These systems are complete, include all necessary solution tanks, covers, gage glasses, low-level cutouts and alarms, motor starters and pumps as required. Automatic electronic controls can be supplied to operate pumps at speeds proportional to feed water flow as measured by flow meters. Systems are available to handle all treating chemicals and to meet all capacity and pressure requirements.

For complete information, ask for Bulletin 4811 and Technical Paper No. 51 "What the Power Engineer Needs to Know about Chemical Feed Systems."

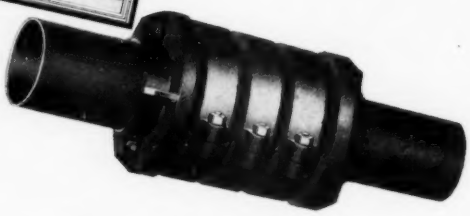
MILTON Roy COMPANY

WITH THE EXCLUSIVE STEP-VALVE DESIGN

1305 E. MERMAID AVE., CHESTNUT HILL, PHILA. 18, PA.

CMH Free-Flexing Expansion Joint

CMH takes the MYSTERY out of expansion joint selection



CMH Controlled-Flexing Expansion Joint

The cloak of mystery is gone—for most services, the new 24 page CMH "Design Guide" simplifies selection and application of expansion joints to a matter of easy-to-use tables. Entering these tables with basic data on your installation you can find the expansion joints necessary to meet your requirements.*

The CMH "Design Guide" also provides a helpful source of general information on expansion control and presents technical data and specifications for CMH Expansion Joints.

Write for a copy of the CMH "Design Guide" and on your next job specify CMH Expansion Joints and eliminate the headaches that are so often a part of selection of this equipment.

***CMH ENGINEERED APPLICATION SERVICE** is available for unusual installations. Competent piping specialists will analyze your problems and make recommendations.*

CMH FREE-FLEXING EXPANSION JOINTS for pressures to 30 psi.; temperatures to 1400°F. Sizes to 24" I.D. Flanges or welding ends. Stainless Steel or Copper.

CMH CONTROLLED-FLEXING EXPANSION JOINTS with precision mated control rings for pressures to 300 psi.; temperatures to 1400°F. Sizes to 24" I.D. Flanges or welding ends. Stainless Steel or Copper.

FOR HIGHER PRESSURES special CMH Expansion Joints can be furnished. Recommendations will be made on receipt of installation details.

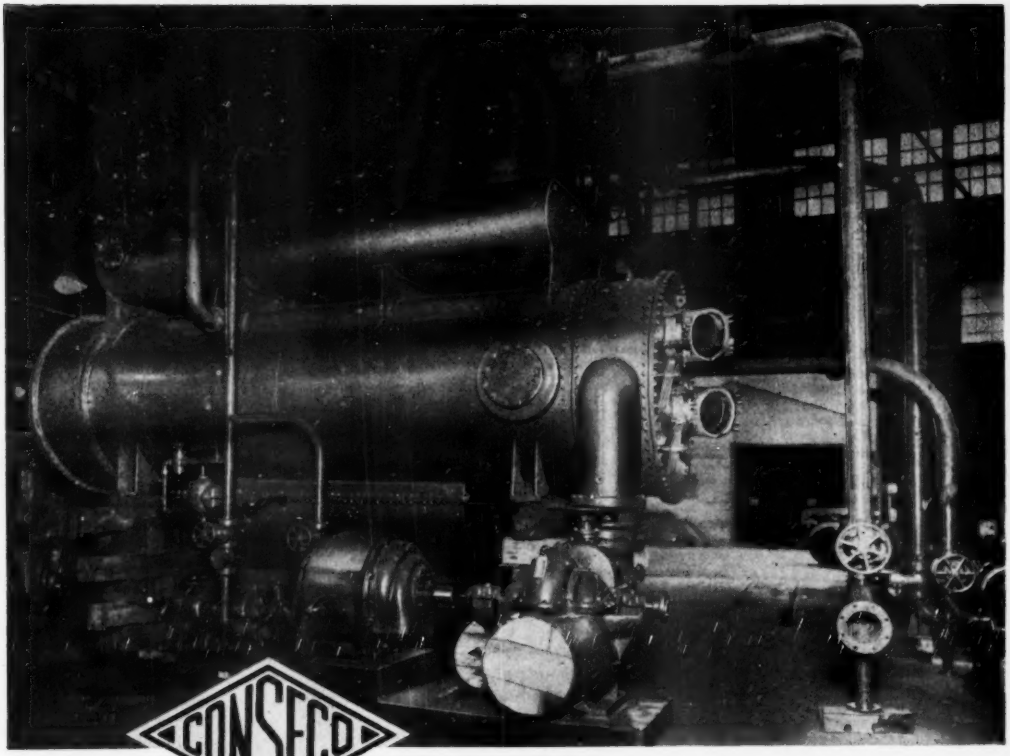
CMH—ONE dependable source for every flexible metal hose requirement

• CMH manufactures all standard types of flexible metal hose, both convoluted and corrugated, in a variety of metals; expansion joints for piping systems; stainless steel and brass bellows; various conduits and special assemblies of these components.

CHICAGO METAL HOSE CORPORATION
EXPANSION JOINT DIVISION

Leaders in the Science of Flexonics
MAYWOOD, ILLINOIS
Plants at Maywood, Elgin and Rock Falls, Illinois
In Canada: Canadian Metal Hose Co., Ltd., Brampton, Ontario

FLEXON . . . . . identifies CMH products which have served industry for more than 47 years.



CONSECO

Designers and Manufacturers of

Steam Boilers
Steam Condensers
Steam Jet Air Ejectors
Evaporators
Stage Heaters
Gas Coolers
Drain Coolers and Heaters
Aftercoolers
Air Preheaters
Fuel Oil Heaters
Jacket Water Coolers
Process Heat Exchangers
Transformer Oil Coolers
Generator Air Coolers
Lubricating Oil Coolers
Storage Tank Oil Heaters
Feed Water Heaters
Distillers
Filters
Industrial and Oil Refinery Heat Exchangers and other types of Heat Exchange equipment
Pressure Vessels, All Codes
Pumps
Salinometer Cocks
Separators—Oil and Water
Strainers
Tube Bundles and Coils
Universal Bevel Gears
Air and Erosion Eliminators
Fibre Plugs
Condenser Injectors (Stop Cocks)
Packing
Tube Inserts, metal or plastic

Maintenance and Repair Service

Redesigning, rebuilding, retubing any tubular equipment.

Superheaters, Water Walls, Economizers designed and built into any boilers.

Tubes tested without dismantling by Hydro-dynamic method. Patented.

Turbines rebladed.

Instruments recalibrated, repaired, rebuilt.

Metal spraying.

COMPLETE PACKAGED CONDENSER UNITS *for*

Easy Installation wherever required

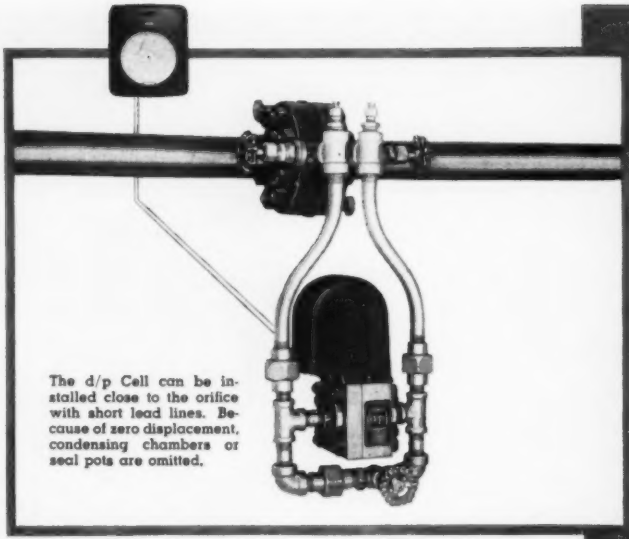
These units for portable or semi-outdoor installation are complete with circulators, condensate pumps, steam jet air ejectors, liquid level controllers, atmospheric relief valves and instrumentation.

The condensing and feed heating plant illustrated is a 6000 KW unit, with 7350 sq. ft. surface; 2088—¾" O.D. 18 gauge Admiralty mixture tubes of 18′ effective length; 6000# steam per hour; 28½" vacuum; 7600 gpm at 70° F.

●

CONSECO Engineers will design and build condenser and heat exchanger equipment to meet your requirements and guaranteed to meet or exceed performance specifications.

CONDENSER SERVICE & ENGINEERING CO., HOBOKEN, N. J.



The d/p Cell can be installed close to the orifice with short lead lines. Because of zero displacement, condensing chambers or seal pots are omitted.

Simpler Flow Measurement

in the palm of your hand

NEW • REVOLUTIONARY • MERCURY-LESS

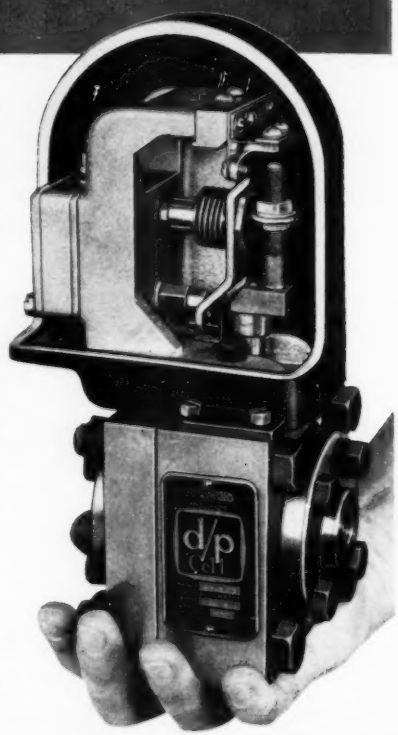
FOXBORO

DIFFERENTIAL PRESSURE CELL

Now you can simplify many troublesome flow problems . . . especially those where corrosion is a factor or the use of mercury is objectionable. This unique flow measuring device is accurate, easily calibrated, and widely applicable, and it weighs only 20 lbs. The Foxboro d p Cell offers a combination of advantages that no other type of flow measurement can duplicate.

The Foxboro d/p Cell operates on the highly-accurate force-balance principle, transmitting flow measurement to remote, conveniently-located pneumatic receiving instruments (indicating, recording, controlling). Range: 100 in. to 800 in. Maximum working pressures: 500 psi and 1500 psi.

Get all the facts about this revolutionary new device for the measurement of liquid, steam, gas or air flow. Write for Bulletin 420. **The Foxboro Company, 68 Neponset Ave., Foxboro, Mass., U. S. A.**



UNIQUE ADVANTAGES

1. Type 316 Stainless Steel Construction.
2. Uses no mercury.
3. Essentially zero displacement—no need for condensing chambers on steam measurement or seal pots on liquid measurement.
4. Immediate, unfailing response to pressure changes.
5. Positive overrange protection.
6. Easy range change.
7. Simple field zero adjustment without disturbing force-balance mechanism.

FOXBORO
REG. U. S. PAT. OFF.

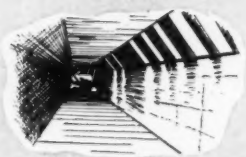
RECORDING • CONTROLLING • INDICATING INSTRUMENTS

WHERE TO USE LUMNITE IN POWER PLANTS

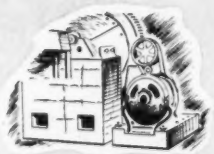
Steel Stack Linings

Ash Pit and Cinder Catcher Linings

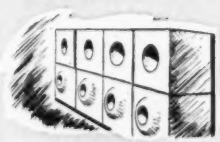
Coal Bunker Linings



Flue and Duct Linings



Overnight Structural Concrete



Castable Refractories

Factory-prepared mixtures of LUMNITE and selected aggregates. Mixed with water on the job, cast into place for door linings, arches, baffles, furnace walls. Special shapes can be cast in molds, ready within 24 hours. Castables to meet different temperature and insulation needs are made by manufacturers of Refractories, sold by their distributors.

P-L-16

In new stacks or old...

PREVENT CORROSION ...BOOST DRAFTS

with LUMNITE* Stack Linings

LUMNITE adds years of service to old stacks. In new stacks, LUMNITE concrete protects the steel indefinitely.

Steel stacks, new or old, get full protection from corrosion and heat when LUMNITE linings are installed. Linings made with LUMNITE and insulating aggregates boost drafts by keeping gas temperatures up and protect against overloading. They resist attacks of condensate and sulphurous gases and the smooth jointless linings allow no "breathing." In addition, LUMNITE linings in breechings withstand the abrasive action of high-velocity gases and fly ash.

LUMNITE linings are easily installed. Reinforcing mesh is attached to steel angles or other projections welded to the steel shell. The mixture of LUMNITE and insulating corrosion-resistant aggregate is applied over the reinforcing mesh. Maintenance costs are low. Outage time for repairs is kept to a minimum because LUMNITE reaches service strength in 24 hours or less.

Besides stacks and breechings, other power plant installations are listed in the column at left. Depending on requirements, LUMNITE provides high structural strength, high heat resistance and low thermal conductivity. Write for free booklets giving complete information on LUMNITE for stacks, and many other refractory, insulating, corrosion and heat resistant concrete installations throughout the power plant.

**"LUMNITE" is the registered trade mark of the calcium-aluminate cement manufactured by Universal Atlas Cement Company.*

Lumnite Division

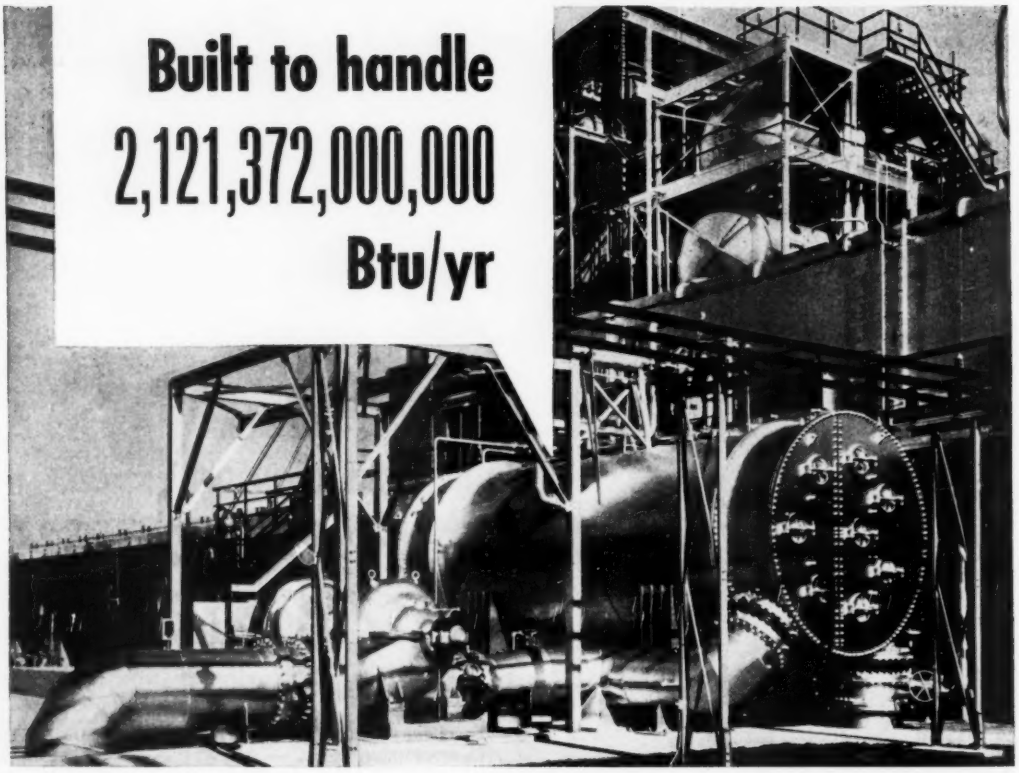
UNIVERSAL ATLAS CEMENT COMPANY

UNITED STATES STEEL CORPORATION SUBSIDIARY

135 EAST 42nd STREET • NEW YORK 17, N. Y.

NBC SUMMER SYMPHONY CONCERTS—*Sponsored by U.S. Steel Subsidiaries—Sunday Evenings—June to September*

Built to handle 2,121,372,000,000 Btu/yr



Ordinarily you would state this condenser's capacity as 242,000,000 Btu/hr. We've expressed the rate *per year* because Lummus designs and builds heat exchanger units so meticulously that you can expect them to render continuous service over long time periods without loss of efficiency. Operating losses due to maintenance requirements are eliminated to the furthest extent that materials limitations permit.

This 27,500 sq ft, 2 pass, nondivided waterbox type surface condenser is a part of the first unit at the semi-outdoor Rex Brown steam electric station of The Mississippi Power & Light Company. It was furnished complete with 2 stage, twin element air ejector and single stage priming ejector by Lummus. The station is designed for an ultimate of four units.

The condenser has a side steam inlet with elbow connection to the turbine and is located alongside the turbo-generator pedestal. It serves a 30,000 kw, 19 stage condensing turbine.

All units of equipment throughout the plant are products of leading manufacturers. In addition to the condenser, Lummus installed the 775 sq ft evaporator, designed to produce 20,000 lb/hr of vapor.

For proper performance over the longest possible periods without downtime, make sure every heat exchanger job goes to Lummus.

THE LUMMUS COMPANY
Heat Exchanger Division
259 West 14th Street, New York 11, N. Y.

LUMMUS

Atlanta • Boston • Chicago • Cleveland • Corpus Christi
Detroit • Ft. Worth • Houston • Minneapolis • Pittsburgh
Rochester • St. Louis • San Francisco • Wayne (Phila.)
Buenos Aires • Honolulu • London • Manila
Montreal • Paris • Rome • San Juan, P. R.

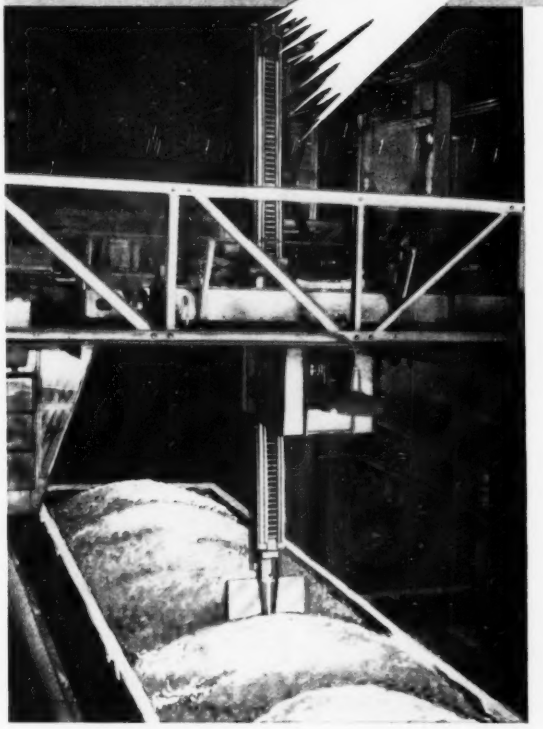
LOOK TO LUMMUS **for Steam Surface Condensers • Evaporators • Feed Water Heaters • Boiler Blowdown Heat Exchangers**
Steam Jet Air Ejectors • Steam Jet Refrigeration • Barometric Condensers • Heat Exchangers • Process Condensers • Reboilers
Steam Generators (Indirect Fired) • Fuel Oil Heaters • Lubricating Oil Coolers • Pipe Line Coolers • Jacket Water Coolers

The Summer Sun is Shining Now

BUT . . .

What about . . . When the

"DEEP FREEZE" Arrives?



It is only a "Hop—Step—and a Jump" from Summer to Winter . . . and woe betide the men responsible for continuous plant operation if the coal is in the hopper cars . . . but not usable!

The Kinney Car Unloader, manufactured and sold only by *Heyl & Patterson,* unloads Hopper Cars of Frozen Coal without the use of heat and without damage to the cars.

The Kinney Car Unloader enables one man to unload a 70-Ton Car of Frozen Coal in 20 minutes or less.

Heyl & Patterson has Kinney Car Unloaders ready now for installation early in the Fall in time to serve your Hopper Car Unloading Needs this coming Winter.

ORDER YOUR H+P KINNEY CAR UNLOADER NOW!

Ask an H+P Engineer to Consult With You

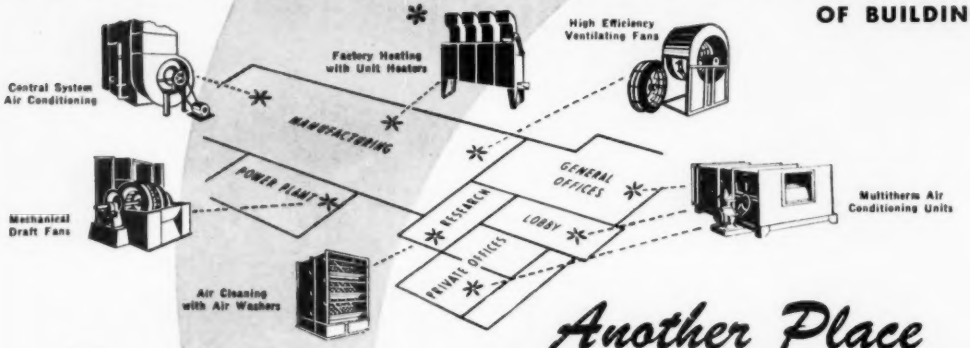
Ore Bridges
Railroad Car Dumpers
High Lift-Turnover-Rotary
Coal Preparation Plants
Coal & Coke Handling Equipment
Boat Loaders and Unloaders
Rotary Mine Car Dumpers
Coal Crushers
Coal Storage Bridges
Car Hauls & Boat Movers
Bradford Breakers
Refuse Disposal Cars
Thorsten Coal Samplers
Kinney Car Unloaders
Pig Iron Casting Machines

Heyl+Patterson, Inc.

"SINCE 1887"

55 WATER STREET · PITTSBURGH 22, PA.

THERE'S CLARAGE EQUIPMENT FOR EVERY NEED IN EVERY TYPE OF BUILDING



Another Place

CLARAGE

Saves You Money

IS IN

FACTORY HEATING

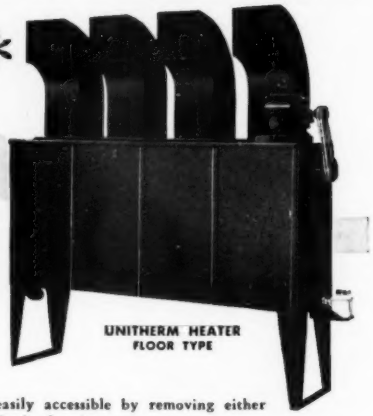
NOT as much fuel required with Clarage Unitherm Unit Heaters . . . the reason, SYNCROTHERM CONTROL.

Here's a patented device, obtainable ONLY on Clarage Unitherms, which controls temperatures by regulating the amounts of return air passing through and/or around the heating coil.

A constant circulation of heated air is maintained — *no stratification; no hot ceilings; no cold floors.*

And since uniform, effective heating is accomplished with LOWER temperature air, *operating economies are substantial.*

If you have any type of industrial heating problem, Clarage Unitherm Unit heaters — and SYNCROTHERM CONTROL — merit your investigation.



UNITHERM HEATER FLOOR TYPE

Unitherms are also built in the SUSPENDED TYPE— to save floor space — installed either along the walls or at the ceiling.

CLARCO HEATERS

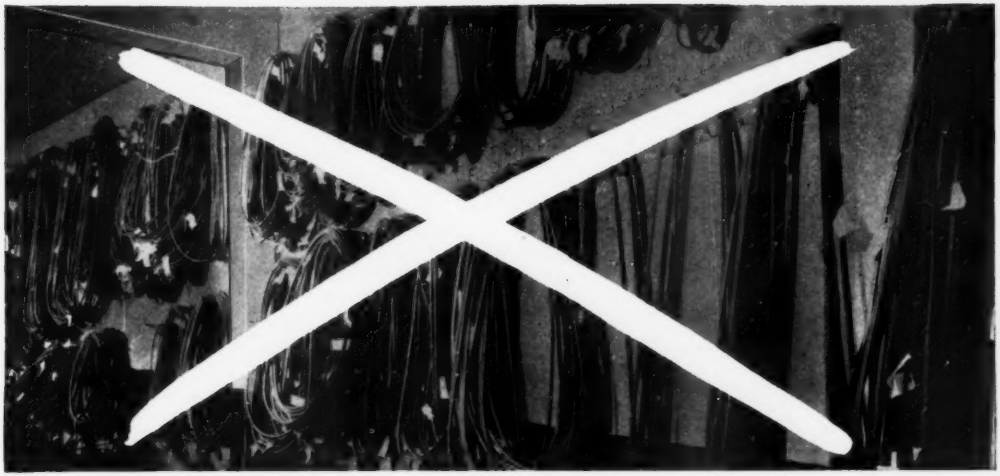
Unitherm Unit Heaters

also have other highly desirable features. Note V-belt drive insuring quieter operation, wide flexibility of output. Note that outlets are square, permitting 4-way adjustment of heat flow. What you can't see are the positive, centrifugal fans which spread heat evenly over wide areas; that every working part is easily accessible by removing either front or back of casing.

CLARCO HEATERS are for smaller heating jobs, and to "help out" present equipment. Both Unitherm and Clarco Heaters are available in a wide range of sizes, operating either on steam or hot water.

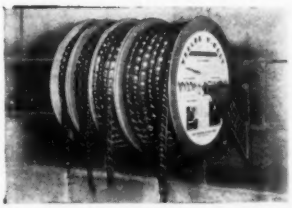
CLARAGE FAN COMPANY

KALAMAZOO, MICHIGAN . . . SALES APPLICATION OFFICES IN ALL PRINCIPAL CITIES

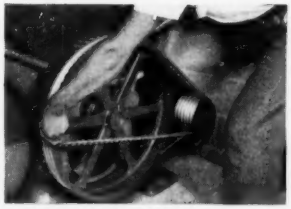


Here's how to cut your v-belt costs

You can replace up to 316 sizes of endless v-belts with just 4 reels of Veelos



From these four reels of Veelos you can make up 316 sizes of O, A, B and C section endless v-belts.



Any length belt can be coupled for quick installation on any drive in a few minutes.

Machine downtime is practically eliminated. Sliding or pivoted motor bases are not needed.

MAYBE you need belts of only one or two widths—but many different lengths—to keep all your drives producing. Then one or two reels of Veelos will give you a *complete* v-belt inventory.

You don't need to tie-up working capital in a heavy v-belt stock . . . you don't need to maintain costly inventory records. *With Veelos, you have the right size v-belt for any drive in your plant—all the time!*

Veelos on reels saves valuable storage space. It simplifies stock records; it eliminates belt deterioration and obsolescence.

Veelos is simple and easy to install. No need to dismantle drives with fixed centers or outboard bearings . . . no long, expensive interruptions to production. Just loop it around the sheave and couple the ends.

Check the advantages of Veelos and you'll agree that it can provide substantial savings for you.

VEELOS
THE LINK
V-BELT

Everyone responsible for power transmission needs this Veelos data book. Gives complete engineering data, measuring and installation directions. Shows Veelos at work on scores of different drives in many different industries. Write and we'll send you a copy *free!*

MANHEIM MANUFACTURING & BELTING COMPANY
MANHEIM, PA.

ADJUSTABLE TO ANY LENGTH • ADAPTABLE TO ANY DRIVE

Made in all standard sizes, fits all standard grooves. Packaged on reels in 100-foot lengths. Sales engineers in principal cities; over 350 distributors throughout the country. Veelos is known as VEELINK outside the United States.

A NEW REFRIGERATION CONDENSERS BOOKLET BY Vogt

Write FOR BULLETIN RC-1

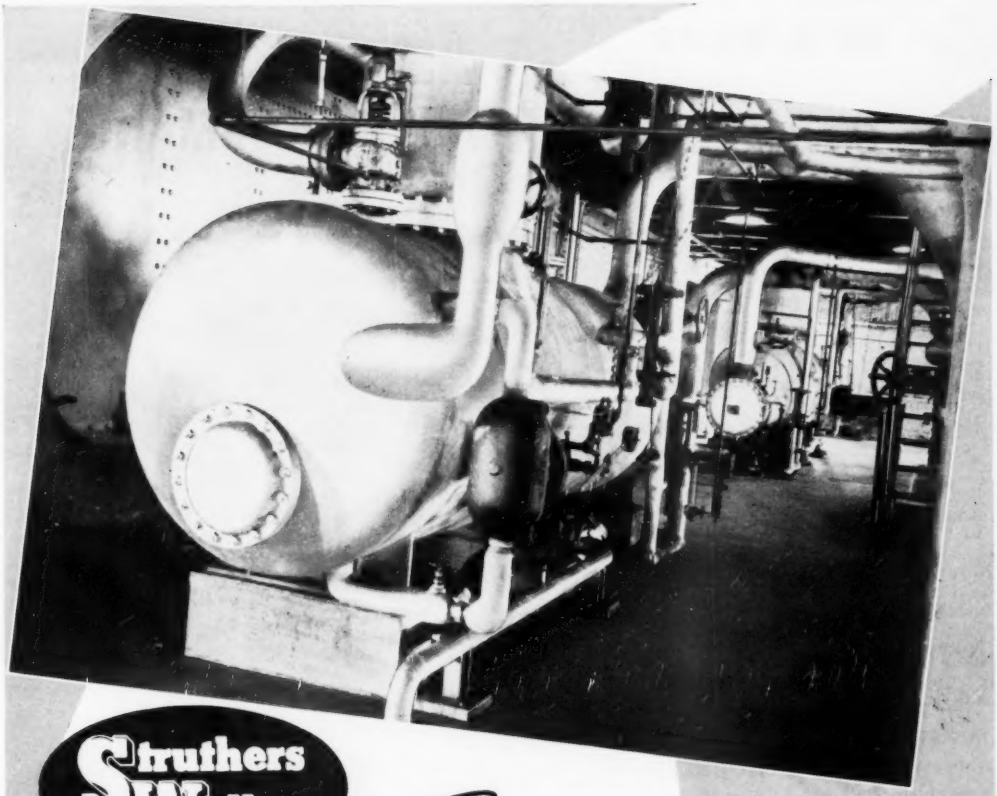
Here's pertinent, up-to-the-minute information on our complete line of refrigeration condensers . . . a 24 page booklet showing types and sizes designed to deliver low temperature liquid with the lowest condensing pressure.

Vogt Refrigeration Condensers are fabricated from top quality plates, tubes, pipes, forgings, and castings by skilled workmen in modernly equipped shops. Units are designed, tested and stamped to A.S.M.E. Code requirements.

Vogt FOR BETTER REFRIGERATION

HENRY VOGT MACHINE CO., LOUISVILLE 10, KY.

BRANCH OFFICES: NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO, ST. LOUIS, DALLAS



Struthers Wells

Evaporators

FOR AN IMPORTANT *Power Plant* INSTALLATION

Shown is another pair of Struthers Wells Evaporators, assuring a reliable source of pure make-up for a new power plant.

Fitting companions for Struthers Wells Closed Feedwater Heaters, these evaporators are available in a wide range of sizes and capacities, with assurance of highest vapor purity, provision for thermal descaling, and sound mechanical construction.

STRUTHERS WELLS CORPORATION

Process Equipment Department

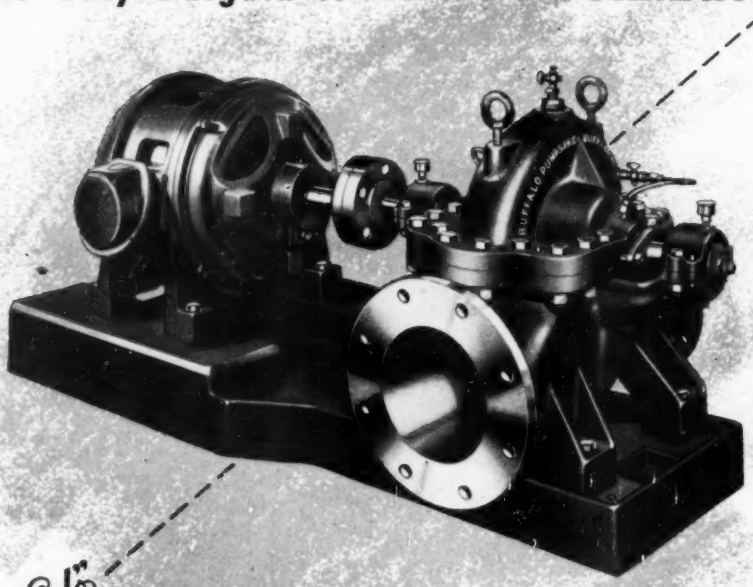
WARREN, PENNA.

PLANTS AT WARREN, PENNA. · TITUSVILLE, PENNA.

OFFICES IN PRINCIPAL CITIES

IN A PUMP

The Only Bargain is TOP PERFORMANCE



"Buffalo" DOUBLE SUCTION CLEAR WATER PUMPS ASSURE IT!

"Buffalo" Type "SL" Clear Water Pumps are a good example of the true economy inherent in quality construction. Their first cost is NOT low, because "Buffalo" has spared nothing in building the highest possible efficiency and the longest life into them! BUT freedom from frequent shutdown for repairs—more gallons per power dollar—are your BIG economies when you specify "Buffalo" "SL" Pumps. And, year after year, these economies pay for that first cost over and over. Next time you specify a clear water pump, specify "SL", the pump users say you can "install and forget".

- Hydraulically balanced operation under all heads and pressures
- All oversize parts for extra long service
- Big water passages in sturdy casing reduce friction losses and sudden velocity changes
- Wide range of sizes 10 to 10,000 gpm; for heads up to 350 ft.

WRITE FOR YOUR FACTS! *Bulletin 955-N, left, is a helpful reference for your files in choosing the best clear-water pump for your job. Also request Bulletin 980-B, on "Buffalo" Class "RR" Pumps for high head work.*

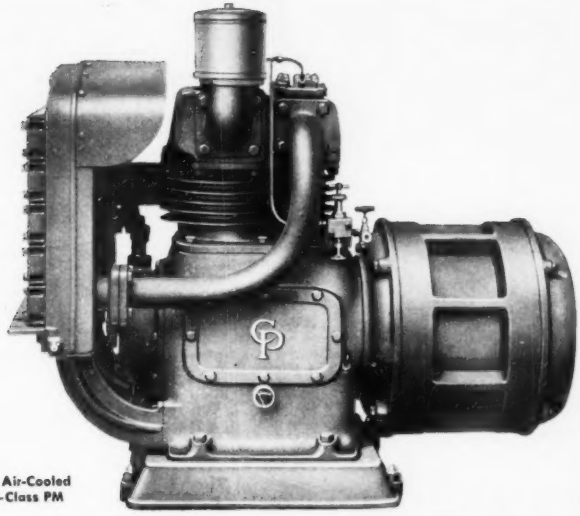
"Buffalo" PUMPS

BUFFALO PUMPS INC.

488 BROADWAY BUFFALO, NEW YORK

Canada Pumps Ltd., Kitchener, Ont.

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID



CP Two-Stage Air-Cooled Compressor—Class PM

compressed air *anywhere* – without waste

CP Two-Stage Air-Cooled Compressor—Class PB

In many large and medium sized plants air is needed in isolated locations. These small, compact CP compressors may be installed independently of the main air system, dispensing with long air lines. They are also ideal for off hour operations.

In smaller plants, the entire air requirements may be met most economically with these small, efficient compressors.

Built to the same high standards as the large CP compressors, Class PM two-stage air-cooled compressors are available in sizes from 139 to 445 c.f.m. piston displacement, with built in motor (as illustrated) and with flexible coupling or V-belt drive.

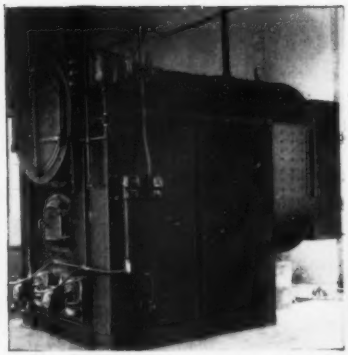
Class PB-20 Compressors are available in three sizes: 7½, 10 and 15 HP, with piston displacement ranging from 39 to 82 c.f.m. Illustrated is the tank-mounted type.

Write for complete information.

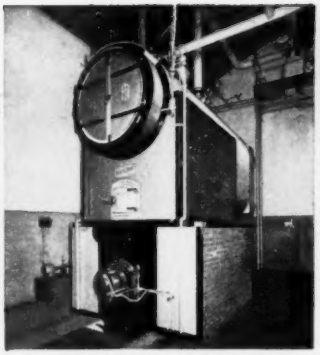
CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

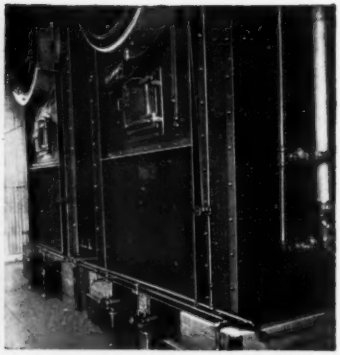
PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



● 80 HP. ECONOMIC with extended sides providing furnace volume for oil firing.



● 150 HP. ECONOMIC with brick base built-up in the field to provide furnace volume for oil firing.

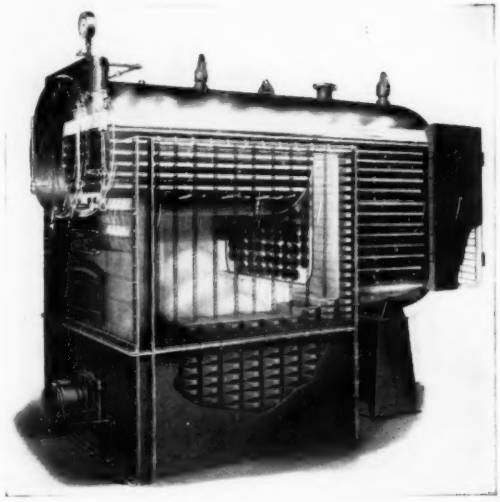


● 2-150 HP. ECONOMICS with extended sides providing furnace volume for oil firing.

For OIL or GAS Firing

THE ECONOMIC BOILER

HUNDREDS of Economics—the boiler refractory lined furnace combination, are gas or oil fired. The furnace volume required with these fuels is provided either by building a brick base in the field, by increasing boiler height (watch railroad clearances) or by the use of the new Erie City Steel Base completely shop fabricated with 13 1/2" refractory lining. This last method eliminates costly brickwork in the field and permits shipment of any standard size of Economic to 300 hp. as one unit and base as a separate unit. This economical steel base can be furnished in heights from 2 to 6 feet and provides a sturdy long life foundation that becomes an efficient addition to furnace volume.



● ERIE CITY'S NEW HIGH REFRACTORY LINED BASE eliminates costly brickwork in the field, speeds the erection of the boiler, and provides the extra furnace volume required for oil, gas, or stoker firing.

The refractory lining of the steel base is the same as used in the well known Economic. It consists of 9" of first grade refractory and 4½" of block insulation or 13½" of refractory depending upon conditions. The weight of the boiler rests on the steel base not on the refractory.

COMPLETE STEAM POWER PLANT EQUIPMENT

ERIE CITY

Complete Steam Generators ● Type C 3-Drum Boilers ● Type VL 2-Drum Boilers ● The "Economic" Boiler with or without Water Walls ● Welded H. R. T. Boilers ● Welded Steel Heating Boilers ● Coal Pulverizers ● Underfeed Stokers ● Welded Pressure Vessels for the Process Industries.

ERIE CITY IRON WORKS • ERIE, PA. • *Since 1840*

HOW TO SAVE POWER, TIME AND MONEY $

Use Garlock 150 Packing on your steam rods!

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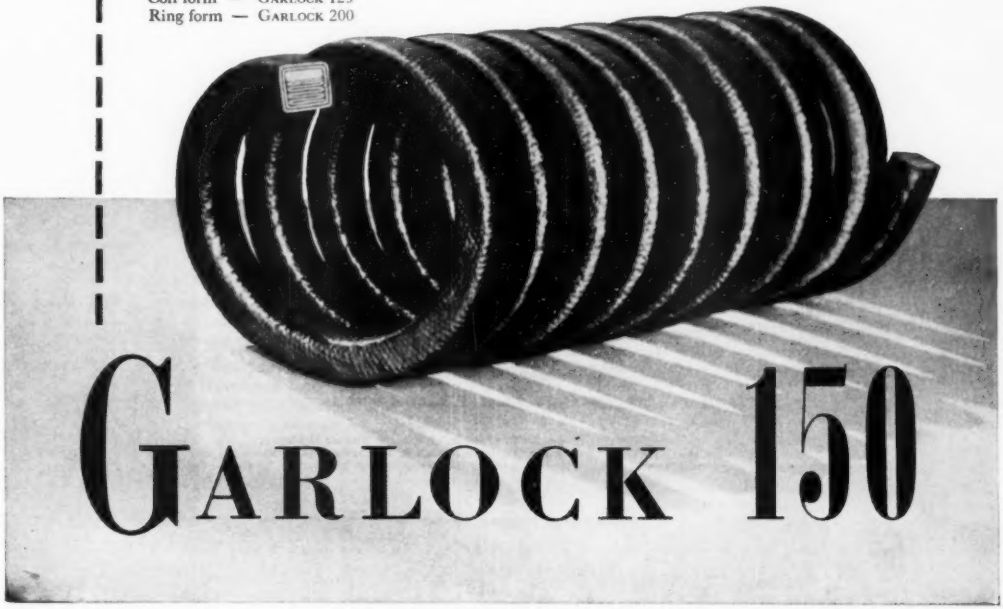

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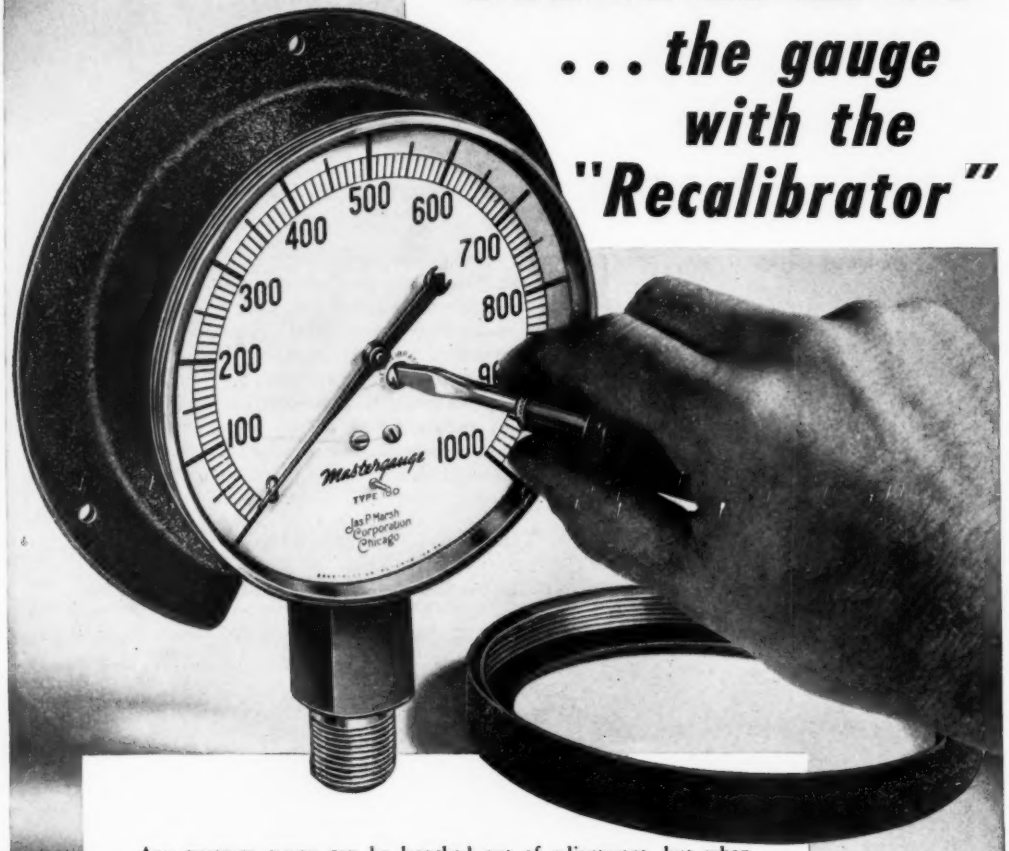
. . . the gauge with the "Recalibrator"



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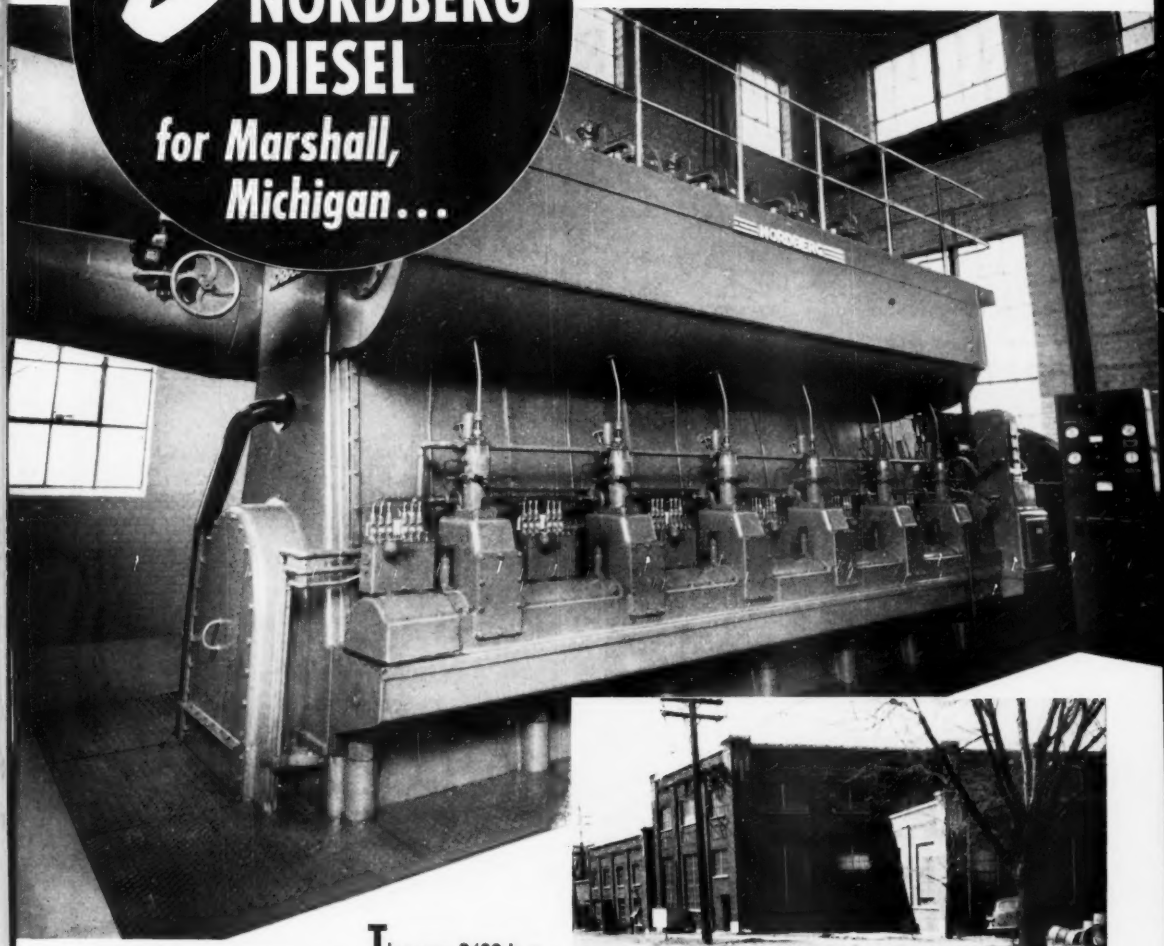
5th NORDBERG DIESEL for Marshall, Michigan...

Views show the exterior and interior of the Municipal Power Plant at Marshall, Michigan, and the new 2400 H. P. Nordberg Diesel recently installed.



The new 2400 h. p. Diesel engine, recently placed in service in the Municipal Power Plant at Marshall, Michigan, is the *fifth* Nordberg Diesel to be installed by that city, and represents their *third* repeat order, *for a total of 6250 H. P.*

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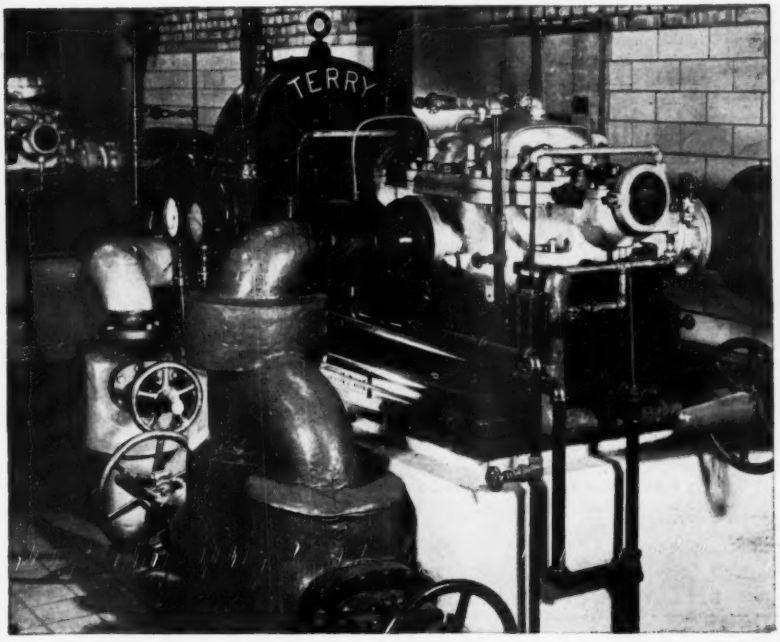

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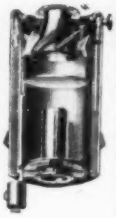

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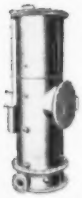

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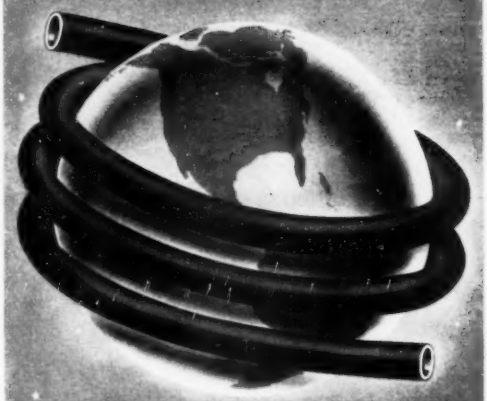

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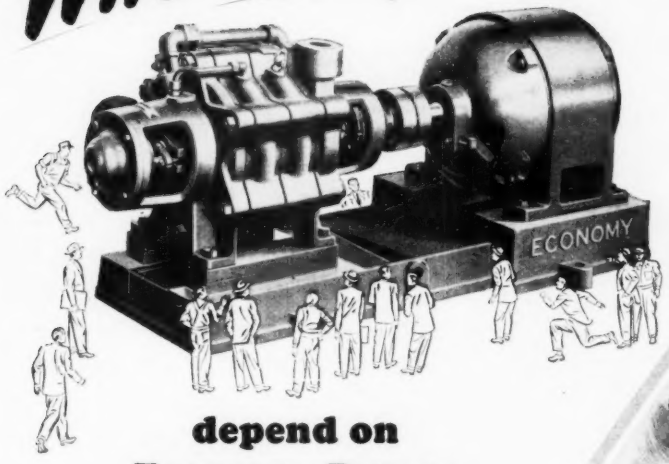

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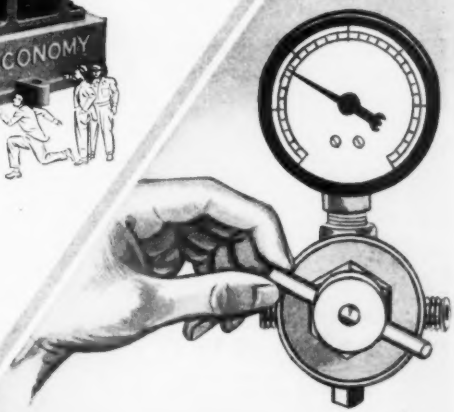

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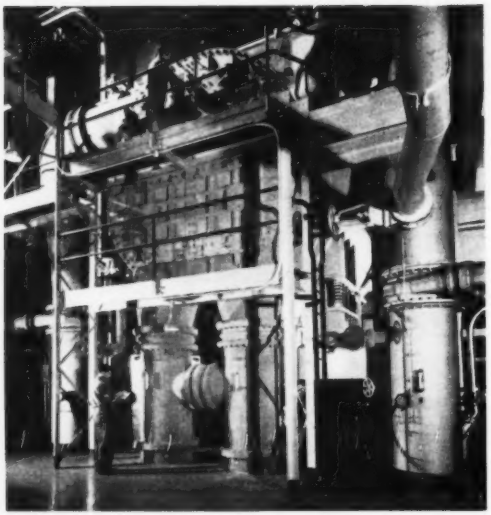

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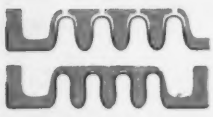

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POSITIONS WANTED

ENGINEER P.E. Wide experience design of Public Utility and industrial power plants, both mechanical and electrical. Heat balance, piping, coal and ash handling, power and light distribution. Calculations, specifications, requisitions and supervision. PW-8054, Power.

MECHANICAL ENGINEER, B.S.M.E., age 29, married, desires responsible position with industrial concern or public utility in maintenance or engineering department. Has had eight yrs. experience in engineering, maintenance, and installation of steam turbines, generators, and auxiliary equipment with leading manufacturer. Prefer midwest location. PW-9436, Power.

M.E. GRAD., June 49, 27, interested in heat exchangers, refrigeration, steam plant equipment, design of small parts. Tau Beta Pi, Pi Tau Sigma. Locate anywhere. PW-9460, Power.

NOTICE OF SALE
RAILWAY EQUIPMENT

Sealed bids will be received by the State of Louisiana, Office of the Governor, Division of Administration, Purchasing Section, 201 Capitol Annex, Baton Rouge, Louisiana, at 10:00 a.m., August 26, 1949 for the sale of Railroad Equipment located at Louisiana State Penitentiary, Angola, Louisiana, and devileved F.O.B. Angola, Louisiana, or Bains, Louisiana. Bids will be received on the following:

1—Mogul type Locomotive #44, built by American Locomotive Co., weight on drives 47 tons, total weight including water tender and fuel oil tank approximately 44 tons.

1—Prarie type Locomotive #22, built by Baldwin Locomotive Co., weight on drives 45 tons, total weight including water tender and fuel oil tank approximately 35 tons.

57—Metal fittings for wood body cane cars, standard gauge, 4 pairs wheels, 342 tons.

31—Metal fittings and frame for steel body cane cars, standard gauge, 4 pairs wheels, 284 tons.

1180—Tons—60 pound rails
230—Tons—40 pound rails
292—Tons—70 pound rails
43—Tons—Spikes
66—Tons—Angle Bars
70—Tons—Tie Plates

Bidder to submit bid based on Owner delivering material onto railroad cars at Bains, Louisiana and an alternate bid if he desires to take delivery at Angola, Louisiana, the Owner to load material onto Buyer's trucks or onto barges at Tunica Landing or Angola, the Owner to deliver material onto barges.

Locomotives and cars will be taken apart into sizes that can be handled on trucks unless delivery is made by barge in which case the amount of dismantling will be such as is agreeable to Buyer and Seller. The quantities shown are approximate and scale weighing of material delivered will govern for payment.

A Bid Bond in the amount of 5% of the amount bid must accompany each bid, which amount shall be retained by the vendor as a performance bond to secure the faithful performance of the contract to be entered into between the vendor and the successful bidder or bidders. After the awards have been made said amounts accompanying the bids of the unsuccessful bidders will be immediately returned to them and/or each of them.

These bids will be publicly opened and read at same hour and date specified above, in Room 201, Capitol Annex. No bids will be received after date and hour specified.

The owner reserves the right to reject any or all bids and to waive any informalities.

State of Louisiana
Office of the Governor
DIVISION OF ADMINISTRATION
J. H. Rester
Commissioner of Administration

By
D. H. Whittington
Purchasing Supervisor

FRED'K W. KAELBER CO.

KAELBER — Since 1923 — FIRE BRICK CONSTRUCTION

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Refractory Linings For Gas Generators, Rotary Kilns, Incinerators, Furnaces

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Guaranteed Electrical Equipment

40th Year

1 YEAR GUARANTEE

RELIABLY REBUILT—DEPENDABLE EQUIPMENT

PARTIAL LISTINGS ONLY

Squirrel Cage Motors

H.P.	Make	Type	Speed
450	G.E. vert.	KF-6338	1180
250	G.E.	IK	1160
250	G.E.	K-568	575
200	G.E.	KF-6335Z	880
147	West.	25 cy.	1750
125	Al. Ch.	AR-630F	450
100	G.E (2)	K-544	1175
100	West.	CS	870
100	G.E.	KT-556	865
100	West. (2)	CS	690
75	West.	CS-5058	1760
75	West.	CS-662-C	1150
75	West.	CS	670
60	West.	504-S	1750
60	Rel.	AA-C5084Z	870
60	West. (2)		900
50	G.E.	FTR-523	3600
50	Elliott	196	3450
50	G.E.	K-445	1170
50	West.	CS	800
40	G.E.	KT-336	900
40	West.	CS	900

Partial List Only!

Slipring Motors

H.P.	Make	Type	Speed
600	C. Wh.		514
200	G.E.	MTP	1800
200	G.E.	IM	1200
150	G.E.	MT-564Y	580
100	G.E.	IM	1800
100	Al. Ch.		690
75	G.E.	IM	870
75	G.E.	IM	690
60	Al. Ch.		690
60	G.E.	M-6326TEFC	855
50	West.	CW-554	1155
50	Al. Ch.	ARY	575
50	F-M	BV	575
50	G.E.	IM	490
40	G.E.	IM	1200

SYNCHRONOUS MOTORS

H.P.	Make	Type	Speed
400	G.E. (4)	TS-982S	600
260	G.E.	TS	900
200	Ideal (2)		257
180	G.E.	ATI	900
150	G.E.	ATI	720
150	G.E.	TS	1200
125	West.	G	1200
100	Elec. Prods.		1200

A.C. GENERATORS

K.W.	Make	Type	Speed
288	West.	G	900
75	G.E.	ATB	360
75	G.E.	ATB	1200

D.C. to A.C. Generators

K.W.	Make	D.C.	A.C.
25	G.E.	230	220
25	Star	115	120
25	Ideal	115	440
25	El. Mchy.	230	440
7½	Hertner	115	440
5	El. Spec.	110	110

550 V. D.C. Motors

H.P.	Make	Type	Speed
765	G.E. (6)	MPC	1045/1350

230 V. D.C. Variable Speed Motors

H.P.	Make	Type	Speed
100	Rel.		1050/T	400/1200

230 V. D.C. Variable Speed Motors (Continued)

H.P.	Make	Type	Speed
75	G.E.	D	500/1500
75	Cr. Wh.	CMC-125H	375/750
60	G.E.	C	480/1100
55	Cr. Wh.	CCM-125H	165/500
50	West.	SK	500/1500
50	West.	SK	250/1000
40	Rel.	461T	400/1200
40	G.E.	CD-1441	400/1500
25	West.	SA	500/1500
25	Rel.	185-T	500/1500
25	G.E.	RF-13	400/1600
25	G.E.	RF-14	400/1200
25	G.E.	RF-14	300/1200
20	G.E. (6)	RF-12	400/1200
20	West.	SK	375/1500
15/20	Rel. (4)	185-T	400/1600
15	West. (4)	SK-95	600/1500
15	F.D.		500/1500
15	West.	SK-12	350/1000
15	West.	SK	250/1000
15	West.	SK	500/1500
10	G.E.	RF-10	600/1800
10	G.E.	CD-83	600/1800
10	West.	SK	600/1200
10	West. (3)	SK	500/1500
10	G.E.	RF	400/1600
10	G.E. (3)	RF	400/1200
10	Rel.	131-T	250/1000
7½	West.	SK-70	500/1500
7½	G.E.	RF-10A	450/1600
7½	Al. Ch.		350/1050
5	West. (3)	SK-60	500/1500
5	G.E.	RF-9	450/1800
5	G.E.	RF	450/1800
5	Rel. (2)	46-T	400/1600

230 V. D.C. Motors

H.P.	Make	Type	Speed
150	G.E.	RC-19	800
125	G.E.	RC-15	1750
100	G.E.	RC-14	1750
100	Al. Ch.		1200
75	West.	SK-170	635
75	West. (2)	SK-180	475
75	Cr. Wh.	52-HM	480
60	West. (2)	S-160	680
50	West.	SK-133	1300
50	Diehl	K-10	850
50	West.	SK	750
50	West. (2)	SK-160	585
40	West.	SK-103	1750
40	Century	DN-454	1740
40	G.E.	RC	1750
40	G.E.	RC-32	1100
40	G.E.	RC-13	1075
30	G.E. (2)	RC	1200
30	West. (2)		975
30	G.E. (2)	RC-33	775
30	West. (2)	SK-143	575
20	G.E. (2)	CD-83	1750
20	G.E. (2)	RC-11	1150
20	Star (2)	SR-316	29.2

115 V. D.C. Motors

H.P.	Make	Type	Speed
300	West.	SK	900
100	Cr. Wh.	CMC	900
25	G.E. (2)	CD	1800
25	Cr. Wh.	CCM	750
20	Century	RS	1750
20	G.E. (2)	CD-83	1750
20	West.	SK-110L	750
12½	G.E.	CDM-85	930/1160

600 V. GENERATORS

KW	Make	Speed
200	Cr. Wh.	900
30	Burke	1750
30	E.D.	1150
20	G.E.	1750

250 V. GENERATORS

KW	Make	Speed
1000	G.E.	900
500	West.	1100
330	Elliot	1200
300	G.E.	1200
300	Al. Ch.	1200
300	West.	900
300	West.	1200
200	G.E. MPC	1200
150	West.	900
150	West.	1180
150	G.E.	600
100	Hertner	1200
75	G.E.	1750
50	G.E.	1200
40	Reliance (4)	1750
30 (3)	G.E.	1750
30	Cont.	1200
25	G.E.	1200
15	G.E.	1750
10	Star	1750
7½	West.	1200
5	West.	1750

125 V. Generators

KW	Make	Speed
250	G.E.	720
150	Cr. Wh.	1200
150	West.	1150
100 (2)	West.	900
100	G.E.	1200
100	El. Machry.	1200
75	Cr. Wh.	1200
75	Hertner	1150
50	Sturt.	2800
40	Cent.	1450
30	Ideal (2)	1750
30	G.E.	1150
30	L.A.	1450
25(2)	El. Mchy.	1150
20	Delco	1200
15	G.E.	1150
10	Rogers	1450
7½	West.	1200
5	G.E.	1750

Low Voltage Generators

Amp.	Make	Voltage
8000	H-V-W.	6/12
1500	H-V-W.	6/12
1000	Col.	6/12
125	Hobart (8)	7½
300	Star	15
67	Cont.	15
750	Star	15
1000	G.E.	15
800	G.E.	22/23
600	Rel.	24
134	West.	24
175	Cr. Wh.	25
550	Col.	27
1600	G.E.	30
800	G.E.	30
100	G.E.	30
200	West.	30

Low Voltage Gen. (Cont.)

Amp.	Make	Voltage
205	G.E.	32
1000	G.E.	33
500	Chandeyssen (2)	40
1000	Chandeyssen (2)	40
205	G.E.	42
24	G.E.	44/54
75	G.E.	50/10
800	G.E.	50

Transformers

4—333 KVA Maloney 2300/4600 Primary 220/440 Secondary

300 KVA—Al. Ch. 3 phase, 4160 V. primary, 230 V. secondary.

300 KVA—Pittsburgh, 3 phase 4160 V. primary, 230 V. secondary.

50 KVA—(2) G.E.-H-KF 2400/4160 Y-122/40 V.

New D.C. Starters

150—230 V. Magnetic 5 H.P. to 75, H.P. G.E., C-H, A-B, W.L. etc.

100—230 V. Manual and Compound 1 H.P. to 5 H.P.—G.E. & C-H.

40—7½ H.P. 230 V. C-H—magnetic reversing.

A.C. Starters

1—475 H.P. West. Magnetic Reduced voltage, 550 V. syn.

4—400 H.O. C-H Bul. 9976 440 volt. Magnetic red. volt. synchronous.

1—250 H.P. C-H. 4150 V. synch. full voltage.

1—150/200 H.P. G.E.—440 V. CR-7065 synch.

3—150 H.P. GE 220V-CR 7061 synch.

New A.C. Starters

40—C-H & A-B 2 and 4 speed Magnetic up to 25 H.P.

20—50 H.P. C-H 440 V. Magnetic.

165—20 H.P. W.L. 440 V. Magnetic.

635—7½ H.P. C-H 440 V. Magnetic.

Air Compressors

425 Cfm. Sullivan 2 stage.

360 Cfm. American 125 lbs.

Electric and Air Hoists

17—2 ton Shepard-Niles, 230 V. D.C.

8—500 lbs. P. & H. Zip Lift, 3 phase.

1—2 ton Thor, pneumatic.

1—½ ton, Thor, pneumatic.

400 Cy. Gen.

1—3 KW G.E., 3 ph. 110 volt.

1—7½ KW G.E. 3ph. 400 cy.

1—10 KW G.E., 200/700 cycle.

1—15 KW G.E. 3ph. 400 cy.

EST. 1910 — L. J. LAND INC. — 40th YEAR

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Quality and Service

"CERTIFIED REBUILT"

DEPENDABLE ELECTRICAL EQUIPMENT AT LOW COST

MOTORS . . . GENERATORS . . . M-G SETS

PUMPS . . . FANS . . . BLOWERS . . . SPEED REDUCERS

PARTIAL STOCK LISTING—WRITE, WIRE OR PHONE YOUR REQUIREMENTS

250 KW Allis-Chalmers M-G Set, DC 120/240V, output, 363 H.P. Synch. Motor, 3/60/440V, 1200 RPM, AC & DC panels, late model, imm. shipment.

M-G SETS

KW	Mfr.	Input V	Output V
450	Gen. Elec.*	2300 AC	275 DC
300	Allis Ch.*	220/440 AC	250 DC
250	Allis Ch.*	440 AC	120/240 DC
200	Gen. Elec.*	2300 AC	250 DC
200	Ridgeway*	2300/4000 AC	550 DC
200	Gen. Elec.	220/440 AC	125/250 DC
150	Cr. Wheeler*	220/440 AC	250 DC
105	Century b.b.	220/440 AC	70 DC
100	Gen. Elec.*	220/440 AC	250 DC
100	Gen. Elec.*	220/440 AC	125 DC
75	Gen. Elec. (2)	220/440 AC	125 DC
50	Gen. Elec.	220/440 AC	250 DC
50	Gen. Elec.	220/440 AC	125 DC
40	Gen. Elec.	220/440 AC	120 cycle
40	Northw'n Conv.	220 AC	230 DC
37½	Whse.	230 DC	240/480 AC
35	Gen. Elec.	220/440 AC	48 DC
30	Gen. Elec.	220/440 AC	250 DC
30	Elec. Prod.*	220/440 AC	50 DC
20	Whse.	220/440 AC	250 DC
15	Gen. Elec.	220/440 AC	125 DC
10	Allis Ch. (2)	220/440 AC	250 DC

*Synch. motor drive.

D. C. MOTORS

H.P.	Mfr.	Type	Volts	Speed
150	Cr. Wheeler b.b.	TEFC	230	600
100	Whse.	SK181	230	450/900
100	Gen. Elec.	C	230	575/1000
75	G.E. New b.b.	CDM	230	1755
75	Cr. W. New b.b.	CMC	230	1150
75	Whse.	SK	230	850
75	Allis Ch.	F	230	800
75	Whse.	813L	115	570
75	Gen. Elec.	BRC	115	1150
75	Northw'n	K20	230	1750
60	Gen. Elec.	RC36	230	680
60	Elec. Dyn.	25-S	230	450/900
50	Allis Ch.	E	230	850
50	Gen. Elec.	RC33	230	1100
40/60	Whse. (2)	SK170	230	500/1000
40	Sprague dyna.	LC	230	750/2000
40	Gen. Elec.	RC32	230	1150
35/50	Gen. Elec.	CD123	230	575/1150
35	Ideal	DV350	230	400/1200
30	Whse. (2)	SK93	230	1750
30	Whse.	S-7	115	900
30	Gen. Elec.	RC31B	230	1150
25	Sprague dyna.	LC	230	750/2000
25	Chand'son (4)	C13	115	850
25	Gen. Elec.	CD85	230	1750
20	Gen. Elec.	RF12	230	400/1600
20	Whse.	SK93	230	1150
20	Reliance	T	230	850
20	Gen. Elec.	CD85	230	1150
20	Whse.	SK130	230	500/1500
15	Whse. (3)	SK90	230	825
15	El. Dyn. b.b.	326	230	1750
15	El. Dyn. b.b.	15S	230	300/1200
15	Whse. (2)	SK80L	230	1150
15	Star b.b. (4)	SQ	230	1200

D. C. GENERATORS

KW	Mfr.	Type	Volts	Speed
150	Cr. Wheeler b.b.	TEFC	250	1200
105	Century b.b.	1500 amp.	70	1200
100	Gen. Elec.	RC17	125	1200
100	Gen. Elec.	C	230	750
75	Allis Ch.	E	250	750
75	Whse.	S	125	600
75	Cr. Wheeler b.b.	CCD	250	1450
75	Gen. Elec. (2)	RC36	125	1200
50	Gen. Elec.	RC36	250	850
50	Gen. Elec.	RC	250	1250
40	Gen. Elec.	RC32	250	1450
30	Elec. Prod.	BP	50	1150
30	Gen. Elec.	RC	250	1500
20	Reliance	T	250	1150
15	Star b.b. (3)	late	250	1750

EXPLOSION PROOF MOTORS

from 1 to 20 H.P. . . . . std. speeds

A. C. MOTORS—25 CYCLE

H.P.	Mfr.	Type	Volts	Speed
150	Whse.	HF	440	900
150	Gen. Elec.	IK-16	440	750
50	Allis Ch.	ANY	440	750
50	G.E. int.	MTC3337	440	750
50	G.E.	I-K	440	750
50	Gen. Elec.	KT339	440	1500
40	Gen. Elec.	KT343	440	750
30	Gen. Elec.	KT327	440	750
15	Whse. TEFC	C8365	220/440	1500
15	Reliance TEFC	C444	220/440	750

A. C. GENERATORS—60 CYCLE

KVA	Mfr.	Type	Volts	Speed
625	Gen. Elec.	ATB	2300	450
500	Allis Ch.	3 brg.	240/480	360
300	Gen. Elec.	ATB	240/480	720
250	Whse.	G	2300	600
200	Gen. Elec.	ATB	240/480	600
187	Gen. Elec.	ATB	240/480	900
156	G.E. 1 brg.	ATB7558	240/480	1200
150	Gen. Elec.	ATB	2300	450
150	Gen. Elec.	ATB	240/480	900
125	Gen. Elec.	ATB	240/480	300
100	Gen. Elec.	ATB	240/480	900
100	Gen. Elec.	ATB	240/480	1200
75	Gen. Elec. New b.b.	AT17552	240/480	1200
66	Gen. Elec.	ATB	240/480	1200
58	Gen. Elec.	ATB	240/480	900
25	L. Allis	ALT	240/480	1200
25	Whse. b.b.	1 ph.	120/240	900
12½	Whse. b.b. NEW		240	1200

A. C. MOTORS—SLIP RING

3 Phase 60 Cycle 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1—	600	Gen. Elec.	I-M	360
1—	500	Allis Ch.	ANY	450
2—	300	Allis Ch. 2200 V.	ANY	720
1—	300	G.E. 2200 V.	I-M	1800
1—	300	Whse. 2200 V.	CW	600
1—	250	G. E. 2300V	MT	300
1—	200	Gen. Elec.	I-M	600
1—	200	Gen. Elec.	IM-17A	450
1—	150	Whse.	MW	450
1—	150	G.E. 2200/4000 V.	I-M	1200
1—	150	Allis Ch.	ANY	600
1—	100	Allis Ch.	ANY	1800
1—	100	Al. Ch. b.b. NEW	ARY	600
1—	100	Allis Ch.	ANY	720
1—	100	Whse. int. 2200 V.	C1856C	600
1—	100	Whse. int.	CI-756A	720
1—	100	Fair. Morse b.b.	HV	900
1—	75	Gen. Elec.	I-M	1200
2—	75	Gen. Elec.	IM-14	720
1—	75	G.E. int. duty	MTC5342	900
1—	75	Ideal int.	AVE	1200
1—	75	Gen. Elec.	MT558	600
2—	75	Gen. Elec.	IN-14	600
1—	75	Gen. Elec.	MT337	1800
1—	50	Allis Ch.	ANY	900
1—	50	Howell	SR437	1200
1—	50	Fair. Morse	BV	720
1—	50	Gen. Elec. int.	ITC	600
1—	50	Whse. int.	CI	600
1—	50	Gen. Elec.	I-M	720
1—	40	Gen. Elec.	MT336	900
1—	37	G.E. int.	ITC	600
2—	30	Gen. Elec.	MT526	1200
1—	30	Gen. Elec.	OMT336	1200
1—	30	Gen. Elec.	MT348	600
2—	25	Gen. Elec.	MT332	900
1—	25	Triumph	SR	1200
1—	25	Gen. Elec.	I-M	600
1—	20	Gen. Elec.	MT503	1800
1—	20	Gen. Elec.	MT326	900
1—	15	P & H b.b. int.	W7	1200
12—	10	Reliance New b.b.	AW-324	1800

A. C. MOTORS—SYNCHRONOUS

H.P.	Mfr.	Type	Volts	Speed
300	Gen. Elec.	AT1	220/440	720
300	Whse.	G	2200/440	600
250	Ideal	2BC-M4	2200	450
250	G.E. 3 brg. .8 PF	AT1	220/440	600
200	G.E. .8 PF	AT1	220/440	900
150	Gen. Elec. .8 PF	AT1	2200	450
150	Gen. Elec.	AT1	220/440	300
125	G.E. splprf. .8 PF	TS955	220/440	1200
125	Gen. Elec.	AT1	220/440	900
100	American b.b.	YGH	220/440	900

A. C. MOTORS—SQUIRREL CAGE

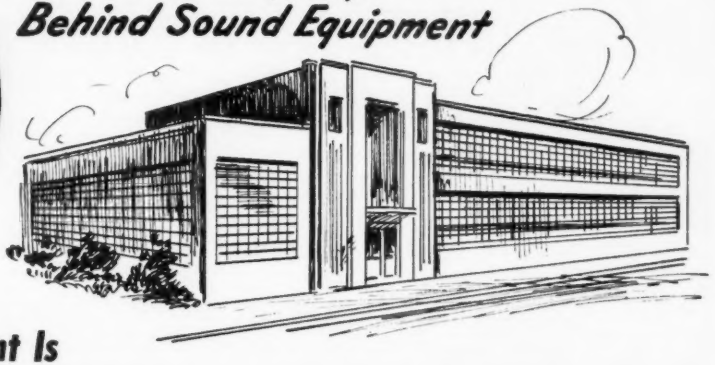
3 Phase 60 Cycle 220 or 440 Volts

Qu.	H.P.	Mfr.	Type	Speed
1—	750	G.E. 2200V.	KT	720
1—	400	Whse. 2200V.	CS	1800
1—	300	Gen. Elec.	IK-16	1200
1—	200	Reliance b.b. NEW	C8085	1800
1—	200	Allis Ch.	AN	1200
1—	150	Gen. Elec.	I-K-16	600
1—	150	Reliance b.b. NEW	14C8085	720
1—	150	Whse. 2200 V.	CS771-1C	1800
1—	150	Reliance b.b. NEW	B6085	1200
1—	150	Gen. Elec.	IK-15	900
1—	125	Reliance b.b. NEW	C5085	1200
2—	125	Allis Ch. 2200 V.	AN	1200
1—	125	Gen. Elec.	IK-16	450
1—	125	Cont. 2200 V. b.b.	SC	1800
1—	125	Gen. Elec.	KT339	3600
2—	125	Rel. TEFC NEW	B6085	1800
1—	100	Gen. Elec.	I-K	1800
5—	100	Allis Ch. 2200 V.	AR226	1200
1—	100	Reliance b.b. NEW	C5085	900
1—	100	Elec. Machy.	b.b.	1200
1—	100	Rel. TEFC NEW	C8085	1200
1—	100	G.E. b.b. NEW	K5043	1800
1—	100	Cont. TEFC	NP582	1200
1—	100	Gen. Elec.	IK-15	720
2—	75	Gen. Elec.	IK	600
1—	75	Gen. Elec.	I-K 14	720
1—	75	Reliance b.b. NEW	C8084	900
1—	75	Gen. Elec.	KT552	900
1—	75	Reliance TEFC NEW	C8084	1200
1—	75	Reliance b.b. NEW	C505	1800
1—	75	Gen. Elec.	KT329Y	3600
2—	75	Reliance b.b. NEW	C505	1200
1—	75	Gen. Elec.	KT347	1200
1—	60	Gen. Elec.	KT552	720
1—	60	Gen. Elec.	KT346	900
2—	60	Reliance b.b. NEW	B504	1800
2—	60	Rel. TEFC NEW	C505	1200
2—	60	Reliance b.b. NEW	C504	1200
2—	60	Whse. H.T.	CS804	1800
1—	60	Wagner b.b.	RF444	3600
1—	50	Whse. b.b. NEW	CS405S	1800
1—	50	G.E. 2 phase	I-Q	900
1—	50	G.E. NEW b.b. HT	K6405	1800
2—	50	Reliance b.b. NEW	C445	1200
2—	50	Gen. Elec.	KT336	1200
1—	50	Gen. Elec.	KT342	900
1—	50	Whse. hislip	WL607	900
2—	40	Gen. Elec.	KT327	1800
1—	40	Al. Ch. 3 speed	ARX	900/600/450
5—	40	Gen. Elec.	KT336	900
2—	40	Reliance b.b. NEW	C404	1800
2—	40	Rel. TEFC NEW	C445	1200
3—	40	G.E.	KT532	1200
2—	35	Gen. Elec.	I-K	720
2—	30	Howell b.b. speed	SC	1800
2—	30	G.E. NEW b.b.	K365	1800
2—	30	G.E. NEW hiburn	KG365	1800
2—	30	G.E. TEFC b.b.	K404	1800
1—	30	Gen. Elec.	I-K	900
1—	30	Gen. Elec.	KT336	720
1—	30	Wagner	22T8P	900
1—	30	Whse.	CS640	900
2—	30	Reliance b.b. NEW	C405	1200
2—	30	Reliance TEFC NEW	C444	1200
2—	30	Cr. Wheeler b.b.	SC30Y	1800
2—	25	Gen. Elec.	KT326	1200
3—	25	Rel. TEFC NEW	C444	900
3—	25	Reliance b.b. NEW	C364	1800
2—	25	Reliance TEFC NEW	B365	1800
2—	25	Reliance b.b. NEW	C404	1200
2—	25	Reliance TEFC NEW	C405	1200
2—	25	Whse. NEW spl. b.b.	CS365	1800
2—	25	Whse.	CS644	900
2—	25	Gen. Elec.	I-K	600
1—	20	Reliance b.b. NEW	C404	900
1—	20	G.E. TEFC b.b.	K404	1200
4—	20	Reliance b.b. NEW	C364	1800
2—	20	L.A. NEW exp. prf.	EX364	1800
2—	20	Whse. NEW b.b. spl.	CS364	1800
2—	20	Gen. Elec.	KT312	1200
1—	20	Whse.	CS	1200
2—	20	G.E. NEW b.b.	K365	1200
2—	20	Diehl TEFC NEW	1NF364	1800
2—	20	Century b.b. 4 speed	SC594	1800
4—	15	G.E. NEW b.t.	K324	3600
1—	15	Gen. Elec.	KT512	900
2—	50	Whse. b.b.	CS504	1200

ARTHUR WAGNER COMPANY

1425 W. RANDOLPH STREET CHICAGO 7, ILL. MONroe 6-7409

A Sound Company Behind Sound Equipment



Where Hemphill Electrical Equipment Is REBUILT — THEN TESTED BY ELECTRICAL ENGINEERS

NO ITEM OF HEMPHILL REBUILT EQUIPMENT IS SHIPPED TO THE BUYER UNTIL TESTS PROVE THAT IT WILL GIVE YOU PERFECT SERVICE

TRANSFORMERS

1—1000 KVA G.E., 3 Ph. auto 4150V.—2300V.
1— 500 KVA Kuhlman 4150 V Pri. 2300 V. Sec.
3— 400 KVA G.E., 6900 Primary—2300 Secondary
3— 300 KVA Pitts., 2300 V. Pri., 115/230 V. Sec.
3— 300 KVA, G.E. type H, 2300 V Pri., 115/230 V. Sec.
300 KVA, Pitts., 7800-440 v.
265 KVA, Whse., 2 ph., 2300 to 3 ph., 4150 auto.
200 KVA, 4000 v.—110/220
100 KVA, Pitts., 1375/2750 v. —110/220
3— 100 KVA G.E. 4150 volt 230/460 volt Pyranol
2— 100 KVA, Wagners, 240/120 v.—120 v.
2— 100 KVA, Newark, 440 v., 3 ph. to 220 V., 2 ph.
2— 100 KVA, Whse., 13800 v. to 250 v.
3— 75 KVA, G.E., 2400 v.—120/240
6— 50 KVA, Whse., 2400 v.—120/240 Interleen
6— 50 KVA Whse., 13,800 v. to 125 v. or 250 v.
6— 50 KVA, Whse., 6900 v. to 125 v. or 250 v.

A. C. GENERATORS

2500 KVA, Whse., 8yn. Cond., 720 RPM, 2400 v.
500 KW, .8 P.F., 3600 RPM, ATB. 600 v.
320 KW, Allis, 450 RPM, 480 v.
240 KW, G.E., ATB, 600 RPM, 600 v.
200 KVA, Allis, 3600 RPM, 240 volt
200 KVA, Whse., 600 RPM, 240 v.
180 KW, Whse., 514 RPM, 550 v.
100 KW, G.E. ATB, 600 RPM, 240 v.
75 KW, Whse., 900 RPM, 220 v.
62½ KW, Allis, 3600 RPM, 220 v.
7— 50 KVA, Whse., 900 RPM, 220 v.
3— 35 KWA, Columbia, 1200 RPM, 240 v.
1—31.3 KVA, America, 1200 RPM, 120/208.
15 KW, Star, 1800 RPM, 220/440.
12.5 KVA, Whse., 1200 RPM, 240 v.

TURBINE BLOWERS

1—Spencer, 1000 cubic feet, 30 oz. pressure with a 15 H.P., 3600 RPM, General Electric Type FT 200 volt motor.
1—Hellmore, 550 cubic feet, 7 inch vacuum, with a 20 H.P. 3600 RPM, General Electric, Type K, 220 volt 3 phase motor.

MOTORS, 3 Phase, 60 Cycles SQUIRREL CAGE

450 H.P., Ridgeway, 900 RPM, 2200 volts.
125 H.P., G.E., EF, 1750 RPM, 2200 v.
125 H.P., U.S., 1200 RPM, Vert., 220 volts.
100 H.P., G.E., 400 RPM, 440 volt.
75 H.P., West., CS, 1750 RPM, 440 volts.
60 H.P., Whse., 900 RPM, Vert., 2200 volts.
60 H.P., Whse., 900 RPM, 440 volts.
2— 40 H.P., G.E., 900 RPM, 220 volts.
40/20 H.P., Westinghouse 600/450 440 volt.
35 H.P., Whse., 1200 RPM, CS, 2200 volts.

MOTORS, 3 Phase, 60 Cycles SLIP RING

2500 H.P., G.E., 257 RPM, 6600 volts.
450 H.P., G.E., 425 RPM, ITC, 440 volts, 25 cycle.
2— 150 H.P., G.E., 1M, 440 volt, 450 RPM.
100 H.P., G.E., 1M, 440 volt, 25 cycle, 720 RPM.
1— 100 H.P., G.E., 1M, 440 V. 400 RPM.
75 H.P., Whse., CW, 720 RPM, 440 volt.
75 H.P., G.E., MT, 1200 RPM, Vert.
50 H.P., G.E., MT, 600 RPM, 220 volt.
2— 50 H.P., Whse., CW, 900 RPM, 220 volts.
40 H.P. Cont., 1200 RPM, JA85 220 volt.

AIR COMPRESSOR

312 CFM, I-R Model 75, 2 stage, 900 RPM, 100# with 75 H.P. Squirrel Cage Mtr.

DIESEL GENERATOR SETS

3—300 KW 125/250 V. De La Vergne Baldwin 6 cyl. 4 cycle with Westinghouse generators

LARGE STOCK OF D. C. MOTORS AND GENERATORS

SYNCHRONOUS MOTORS

4—200/100 H.P., Whse., 720/360 RPM, 4150 v.
200 H.P., Whse., 600 RPM, 240 v.
1—200 H.P., G.E., 257 RPM, 440 volt.
1—150 H.P., G.E., 1800 RPM, 220 v. TC
2—150 H.P., Allis-Chalmers 360 RPM, 2200 V.
75 H.P., G.E., 1200 RPM, 440 v.
70 H.P., Elevt. Mach., 180 RPM, 2200 v.
40 H.P., Whse., 1800 RPM, 220 v.
25 H.P., G.E., 1200 RPM, 2200 v.
20 H.P., Whse., 1800 RPM, 220 v.

MOTOR GEN. SETS

1—1000 KW., Whse., 275 V.—4150—720 RPM, Syn.
1—1000 KW, G.E., 600 volts—4150—514 rpm, Syn.
1— 400 KW, G.E., 250 V. 900 RPM, 2300 V. Syn.
1— 500 KW., G.E., 575 V. 900 RPM. 2300 V. Syn.
125 KW., CW, 125 v., 1200 RPM, 2300 v. sq. cage.
100 KW, el. Mach., 125 v., 1200 RPM, 4150 v. syn.
100 KW, G.E., 230 v., 900 RPM 4150 v. Syn.
2— 75 KW., G.E., 125 v., 1200 RPM, 220/440 v.
6— 75 KW., G.E., 60 v., 1200 RPM, 220/440 v.
50 KW., Ridgeway, 550 v., 1200 RPM, 220 v.
25 KW., G.E., ATI, 1800 RPM, 40 HP, 1800 RPM, 230 v.

PLATING M.G. SETS

250 Amp. G.E., 5/6 volt, 220 v.
500 Amp., Hansen Van Winkle, 24 volt, 220/440 v.
2500 Amp., Chandeysson, 6/12 v., 400 RPM, Syn., 440 v.
2000 Amp., Chandeysson, 6/12, 400 RPM, syn., 440 v.

ENGINE GEN. SETS

150 KVA, G.E., Ames Uniflow, 220 v., 3 ph., non cond.
2— 5 KW, Gasoline, Hobart, 1800 RPM, 120 v., 1 ph. cont. engines.
1—200/275 H.P., Gasoline Engine, Van Blerck, 8 cylinder, 1500/900 rpm.

TURBO GEN. SETS

625 KVA, Whse. 2400 v., 3 phase, non-con.
500 KW, G.E., ATB, 240 v., 3 ph. cond.
60 KW, Whse., 120 v., D.C., cond.

STEAM TURBINES

500 HP., G.E., 3 stage, 165#, 3240 RPM.
800 HP., Terry Tandem type, 720 RPM, red. gear

A GUARANTEE IS NO BETTER THAN THE COMPANY THAT GIVES IT — IT PAYS TO GET A *HEMPHILL* GUARANTEE

THIS SEAL IS YOUR GUARANTEE

"FOR POWER"

J. L. HEMPHILL & CO.

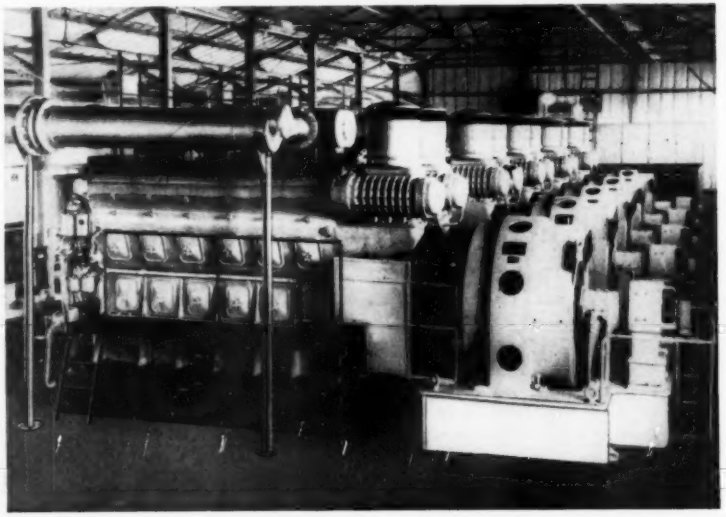
1604 53rd STREET, NORTH BERGEN, N. J.

PHONE NEW YORK - LONGACRE 5-3227

PHONE NEW JERSEY — UNION 3-2600

Another AGsco DIESEL POWER INSTALLATION

FIVE 720KW GMC UNITS "ON THE LINE" IN ENGLAND



Remanufactured and Tested at Our SAUSALITO (San Francisco) CALIF. Shops, These Five 1080BHP GMC Model 12-567 Diesel Engines Connected to 900KVA, 720KW G.E. Generators Are in Continuous Service at the Parkinson Strip Mining Co. Ltd., Bedington, ENGLAND.

Save on Initial Acquisition Costs with "AGSCO REMANUFACTURED DIESEL EQUIPMENT." Submit Your Power Requirements Today.

UNITS AVAILABLE FOR IMMEDIATE SHIPMENT

KVA	MAKE	MODEL	HP	RPM	KVA	MAKE	MODEL	HP	RPM
1420	Fairbanks Morse	38D8⅛	1600	720	312	General Motors	8-268A	450	1200
1250	General Motors	16-278A	1600	720	200	Buckeye	80	240	600
1000	General Motors	12-278A	1200	720	187	Ingersoll Rand	S	225	514
900	General Motors	12-567	1080	720	156	Buckeye	E	187	400
625	Alco	6-12½x13T	750	600	125	Generql Motors	3-268A	150	1200
625	Baldwin	VO-8	750	514	75	General Motors	6043C	90	1200
625	Superior	OS	750	327	75	Fairbanks Morse	35E	90	450
425	Baldwin	VO-6	510	450	62	Int'l. Harvester	UD-18	76	1200
400	Buckeye	80	480	600	50	General Motors	4-71	60	1200
375	Enterprise	DSG-6	450	450	18	Int'l. Harvester	UD-6	22	1200

Engineered AGSCO DIESEL POWER

ESTABLISHED 1898

A. G. SCHOONMAKER Company, Inc.

Diesel Engines • Power Machinery

52 CHURCH STREET, NEW YORK 7, N. Y. PHONE Digby 9-4350

SEARCHLIGHT SECTION

You can look with confidence to RE-NU-BILT EQUIPMENT

REBUILT IN ACCORDANCE WITH N.I.S.A. STANDARDS

RE NU BILT — BELYEA — MOTORS

SUCCESSFUL OPERATION GUARANTEED

MOTOR GENERATOR SETS
3 ph. 60 cycle

Qu.	KW	Make	Speed	D.C. Volts	A.C. Volts
1	1800	G.E.	600	125/250	4000
1	1500	G.E.	600	600	2300/4150
1	1500	G.E.	360	275	2200/4400
1	1250	G.E.	600	275	2300
1	1000	Whse	900	600	2300/4150
1	1000	Whse	720	600	2300/4150
1	1000	West.	514	250	4150
1	1000	Whse.	514	600	4150
1	800	G.E. (3U)	1200	120/240	2300
1	750	Whse	900	250	2300
1	500	G.E.	720	600	2300/4150
1	500	G.E.	720	125	2300/4000
2	400	G.E.	720	250	440/2300
1	400	G.E.	1200	120/240	440
1	350	G.E.	900	125	2300/4150
1	300	G.E.	1200	250	440
1	150	G.E.	1200	250	550
1	150	Cr. Wh.	1200	250	440
1	140(3U)	Cr. Wh.	690	125/250	2300
1	100	G.E.	1170	125	220
1	75	Cr. Wh.	1170	250	220/440
1	75	Cr. Wh.	1200	250	550

SYNCHRONOUS CONDENSERS

Qu.	Kva.	Make	Type	Volts	Speed
1	5140	Whse.		4150	600
1	4000	G.E.	TSC	2400/4800	900
1	3000	Whse.		4800	720

ROTARY CONVERTERS
60 Cycle

KW	Make	Speed	D.C. Volts	A.C. Volts
1—2000	G.E.	514	600	13800
1—2000	G.E.	450	600	2300
1—1000	Whse.	900	600	11000
1— 750	Whse.	900	600	13200
1— 500	Whse.	900	250	2300

FREQUENCY CHANGER SETS

1—1000 KW Al. Ch. Consisting of 1400 HP. 2300 V. 3 ph. 25 cy. Motor and 1000 K, 2300 V. 3 ph. 62½ cy. gen. switch exciter.

1—1000 KW GE 2 unit—3 Brg. Consisting of 1400 HP—4400 V., 3 ph. 25 cy. Motor and 1000 KW—2300 V. 2 ph. 58.3 cycle gen. with exciter (Gen. can be reconnected for 800 KW 3 ph.)

1—320 KW GE 2 Unit 3 Brg. consisting of 600 HP 440 V., 3 ph. 60 cy., 8 pf. Syn. Motor and 400 KVA, 8 pf, type AT 3 ph, 120 cy, 720 volt AC generator with direct connected exciter.

SPECIAL—MERCURY ARC RECTIFIERS

1—750 KW GE Type RHW—6 Anode 575 V., D.C. Form C with 2300 V., 60 cycle transformer and switching equipment.

1—1000 KW American B.B. Type GRZ-612 12 anode 625 V.D.C. with 1040 KVA 015C—3 phase 13200 6600V-25 60 cycle transformer with full automatic switching equipment along with 2 distribution panels.

1—1000 KW Al.Ch. type B-612 12 anode 625 V.D.C. with 1140 KVA 015C 3 phase 13500V. 60 cycle transformer with manually operated switching equipment along with voltage regulator and grid control.

D. C. MOTORS

HP	Make	Type	Volts	Speed
1—1750	Whse		600	525/720
2—1500	Whse.		525	600
1—1200	Whse.		600	425
1—800/1000	Whse.		450	600/720
1—700	G.E.	MCF	600	150/525
1—650	G.E.	MPC	230	115/145
1—600	Al. Ch	MILL	230	400/800
1—300/400	G.E.	DYNA	250	1325/2500
1—335	Whse.	MQ	250	300/900
1—200/300	G.E.	MPC	230	360/920
1—275	Whse.	QM-600-6	230	425/850
1—250	G.E.	MPC	230	400/500
1—230	Al. Ch.		230	700
1—150	G.E.	MPC	230	250/450
1—150	Cr. Wh.	CCM	230	300/1050
1—150	G.E.		600	250/750
10—150	Cr. Wh.	83H	230	890
1—150	Cr. Wh.	CMC-65H	230	1150
2—125	G.E.	CO-1832	230	625
1—125	El. Dy.	308	230	750/1500
1—115	Cr. Wh.	JHL	230	1200
3—101	Whse.	8K	230	485/950
1—90	G.E.	CDM-1242Z	115	1800
1—50/100	G.E.	CD-175	230	365/730
2—80	El. Dy.	308	230	475/1350
1—75	Cr. Wh.	CMC	230	500/1500
1—75	Whse.	SK-100L	125	650
2—75	El. Dy.	25-SL	230	750/1750
3—60/75	Whse.	SK-200	115	300/700
4—75	Cr. Wh.	53-H	230	860
2—75	G.E.	CDM-1126Y	230	2000
1—60	Whse.	SK-160	550	680
1—60	El. Dy.	25-S	230	525/1050
1—60	Whse.	SK	230	500/1000
1—60	Whse.	SK-131	230	500/1500
1—60	El. Dy.	258	230	750/1500
2—50	G E.	RCP-31B	230	1700
4—50	Whse.	Hoist	230	400
1—50	Whse.	SK-153	230	690/1035
1—50	Cr. Wh.	CMC-80H	230	380/750
1—40	Whse.	SK-103	230	1800/2400
3—40	Rel.	38ST"VS"	230	400/1500
with 40 KW MG sets, 230 v. D.C. Exciters and automatic "VS" control.			220/440-3-60	
2—35	G.E.	RF-14	230	250/1000
2—30	G.E.	CD-115	230	500/1500
7—25/30	G.E.	CD-105	230	690/2070
7—25	Whse.	SK-93	230	1310/1750

TURBO GENERATORS

Qu.	KW	Make	Desc.
1	4000	G.E.	Auto Extraction 250# ISP 15# Ext. 2400V. 3 ph. 60 cy.
1	2000	G.E.	Condensing, 175# ISP—6600V. 3 ph. 60 cy
1	1000	G.E.	Condensing 135/150# ISP 2300/4150V. 3 ph. 60 cy.
2	750	G.E.	Condensing 250/275# ISP 440V. 3 ph. 60 cy. (New 1944)
1	450	Whse.	Condensing 250/275# ISP 440V. 3 ph. 60 cy.
1	300	G.E.	Non-condensing 150/175# ISP 5/15# B.P. 480V. 3 ph 60 cy.
1	300	Al. Ch.	Condensing 425# ISP Geared to 1200 RPM. 120/240V. D. C.
2	200	Cr. Wh.	Condensing 250# ISP Geared to 1200 RPM—125V. D.C. Gen.
1	200	Whse.	Non-condensing 150# ISP 7# B.P. 240V. 3 ph. 60 cy.
1	100	G.E.	Non-condensing 150# ISP 2300V. 3 ph. 60 cy.

A. C. MOTORS
3 ph. 60 cycle
SYNCHRONOUS

HP	Make	Type	Volts	Speed
2—3500	G.E.	T8	2300	257
1—2100	G.E.	ATI	4600	514
2—2000	Whse.		2300	120
1—1000	Whse.		2300	1891½
2— 900	Al. Ch.	(New)	2200	150
1— 650	Whse.	NG	2200	138
1— 600	Whse.	Syn.	440	360
1— 600	G.E.	ATI	4800	900
1— 500	G.E.	T8	4150	600
1— 450	Whse.	Eng.	2200	128.5
2— 350	G.E.	T8	2200	150
1— 320	G.E.	ATI	2300	600
1— 300	G.E.	ATI	440	720
1— 300	Whse.		2300	720
1— 300	Al. Ch.		440	600
1— 145	G.E.	ATI	550	720
2— 125	G.E.	ATI	440	450
1— 100	Whse.		550	600
2— 100	G.E.	TS-7651	440	450
1— 100	G.E.	T8	440	1800
1— 100	E.M.	Unused	440	600

SLIP RING

1—1000	Whse.	CW	2300	700
2— 700	Whse.	CW	2300	900
1— 500	G.E.	IP	550	505
1— 500	G.E.	IM-Mill	2200	450
3— 450	G.E.	IM	440	506
1— 400	G.E.	IM	440	720
3— 350	Whse.	CW	2200	900
1— 350	G.E.	MT-442Y	2200/4000	253
1— 300	Al. Ch.	3 Brg.	2300	505
1— 300	G.E.	IM	440	720
9— 300	Al. Ch.	ANY	2200	708
1— 250	G.E.	MT-424Y	4000	257
1— 250	G.E.	MT-559S	2200	1750
4— 100	G.E.	MT-566Y	440/2200	425
2— 100	G.E.	IM-16	2200	435
3— 100	G.E.	IM	440	600
3— 100	Al. Ch.	AK	2200	1200
1— 75	Whse.	CW-761	2300	1750
1— 60	Cr. Wh.	125-AQ	220	700
2— 50	Whse.	CI-638A	220	870
2— 50	Whse.	CIW-504	440	870

SQUIRREL CAGE

1— 250	G.E.	KT-559	440	800
1— 200	G.E.	JK	550	865
1— 200	G.E.	KT-557	440	1800
1— 125	Whse.	M8	440	485
1— 125	(New) G.E.	KF-TEFC	440	1190
1— 125	G.E.	KF-TEFC	440	3585
2— 100	Al. Ch.	AR	2200	1170
1— 100	G.E.	IK-Vert.	2300	450
2— 100	G.E.	KT-543	220/440	1750
1—60/20	Whse.	CS	220	900/450

TRANSFORMERS
60 Cycles

Qu.	KVA.	Make	Type	Ph.	Voltages
3	1250	G.E.	H	1	6600 x 550
1	1050	G.E.	WCTH	3	11000 x 445
1	1000	Maloney	OISC	3	13200 x 480
1	600	Penn	OISC	3	13200 x 120/208
1	600	Al Ch.	OISC	3	4000/2300 x 216
3	333	Pitts	OISC	1	26400 x 2600
3	250	Al. Ch.	OISC	1	2200 x 130
3	200	Whse.	OISC	1	7200 x 240/480
6	167	G.E.	OISC	1	2400 x 240/480
3	150	G.E.	OISC	1	2200 x 220/440
3	100	Al. Ch	OISC	1	2200 x 130
4	75	G.E.	H-KR	1	13200 x 110/220

SPECIAL OFFERING

1 Set—36 New Factory Armature Coils. For 1250 KW G.E. Generator Rigid Frame. Type ATB2—3600 RPM, 3 phase, 60 cycle, 480 volts.

Remember this name **BELYEA COMPANY, INC.**

Main Office and Shop
43 HOWELL ST., JERSEY CITY 6, N. J.
Phone — Journal Square 2-3334
Also N. Y. City Line — Rector 2-7150

OUR 41 YEAR REPUTATION IS YOUR PROTECTION

GLOW

SQUIRREL CAGE MOTORS

HP	RPM	Volts	Make
750	600	6600	Westgh.
400	1200	440	GE-I-17
350	3550	2200	Westgh.-CS
350	514	440	GE-I
300	600	440	GE-I-17
250	1200	440	GE-KTR
250	600	2300	Triumph
225	514	440	GE-I-14
200	490	2200	GE
200	600	440	Westg'h-CS
150	600	2200	GE
125	1200	440	Century
125	340	220	A-C
100	1800	2300	Burke
85	3600	2200	GE
75	1800	220/440	GE-K5058
75	900	2300	GE
60	3600	2300	GE-KT
60	1800	220/440	A-C, AR
60	1800	2300	GE-FTR
50	3600	440	R. & M.
50	1800	220	Triumph
50	900	220	GE
50	720	2300	Wtg.-CS
40	900	2300	Wtg.-CS
40	720	440	GE-KT
30	1200	dual	Master
30	900	220	AI.-CR.-AR. fr. 220e
30	900	220	Wagner (Hi-Torque)
30	720	220	GE-HJ
30	514	440	Stanley
25	3600	dual	L-A
25	1800	dual	GE
25	1200	220	Wesche
25	900	440	GE
25	900	220	Westgh.-CS
25	720	220	Wagner
25	600	440	GE-I
20	3500	440	AI.-Ch.
20*	1800	220/440	Master
20*	1800	220/440	Wesche
20	1200	440	Al. Ch.
20	900	440	Wtg.-CCL
20	600	220	GE-KT

ENCLOSED SQUIRREL CAGE

HP	RPM	Volts	Make
125*	1200	440	GE-TE-FC-BB
75	1200	2200	GE-TE-FC-BB
60	900	440	GE-TE-FC-BB
30	900	440	Reliance, TE-FC-BB
20	3600	dual	Delco-TE-FC-BB
20	1200	440	Wagner
20	900	440	GE-TE-FC-BB
15	1800	dual	Delco
15	1200	220/440	Delco-TEFC-BB
15	900	440	GE-TE-FC-BB
10	1200	440	GE-TE-FC-BB
7½*	1800	dual	Wagner-TEFC-BB
7½*	1800	dual	Master-TEFC-BB
7½	1200	dual	GE-HI Slip-TE-BB
7½	1200	dual	Delco
7½	1090	220/440	GE-HI Slip
7½	900	dual	Delco-TEFC-BB
5	3600	dual	Delco-TE-FC-BB
5*	1800	dual	Master-TEI C-BB
5	1800	220	Wagner TE-B BB
5*	1200	dual	GE-TEFC-BB
3	3600	dual	Delco, TE-FC-BB
3	1800	dual	Delco-TEFC-BB
3	1200	dual	Rel-TEFC-BB
3	900	dual	Delco
2	1800	dual	Delco-TEFC-BB

*New Motor

ENCLOSED SQUIRREL CAGE—Cont'd.

HP	RPM	Volts	Make
2	1200	220	GE-TE-BB
2	900	220	Wagner-TE-BB
1½	900	dual	Delco-TEFC-BB
1½	1800	dual	L. Al-TE-BB
1½	1200	dual	Delco-TEFC-BB
1	3600	dual	Haskins-TEFC
1	1800	dual	Master-TEFC-BB
1*	1800	dual	Delco-TE-BB
1	1200	220	GE-KT
¾	3600	4400	Delco-TE
¾	1800	dual	Wesche-TE-BB
¾	900	dual	Delco-TEFC-BB
½	1800	440	Delco-TE-BB
½	1800	dual	Delco-TE-BB
½	1200	220	Cr.W h-TE
½	900	dual	Delco-TE
113	1800	440	Delco-TE

SLIP RING MOTORS

HP	RPM	Volts	Make
500	900	440	GE-3 Brg.
400	1200	2300	Al. Ch.
400*	514	2300	C-W Short Shaft
375	1800	2300	Al Ch.
350	900	2300	Westgh.
300	720	2300	Al. Ch.
300	708	2200	Al Ch.
250	300	2300	Al. Ch.
235	1800	220	GE-I
75	1800	220	GE
75	900	440	Al.-Ch., ANY
60	1800	dual	Al. Ch.
60	900	2300	Burke
60	900	220	Wesche
50	1800	220	GE-MT
50	900	2300	Ridgeway
50	900	440	Wagner
50	720	440	Al. Ch.
40	1200	220	GE-MT-336
40	720	2300	Wtg.-HF
40	720	220	Al. Ch.-ARY
40	600	2300	Al. Ch.-ARY
40	600	220	Al. Ch.-ARY
40	450	220	Triumph-C
35	900	220	Al. Ch.
35	900	2300	Ridgeway
35	720	220	GE
35	900	2200	GE
30	1800	2300	Wtg.-CW
30	1800	220	GE
30	1200	440	Wagner
30	1200	2300	Lincoln
30	900	220	GE-MT
30	900	2300	F-M
30	720	220	GE-I
30	600	220	F. Morse-BV
25	1200	220	Wesche
25	600	220	Watson

*New Motor

VERTICAL MOTORS

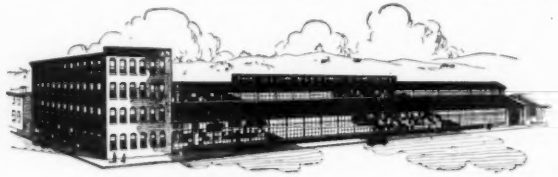
HP	RPM	Volts	Make
200	1200	440	Al. Ch.-SR
150	1200	2200	GE-I-SR
150	1200	440	GE-Cage
125	1200	2300	Al. Ch.-SR
125	1200	2300	Al. Ch.-Cage
100	1200	440	GE-Cage
75	1200	dual	Westgh.-Cage
75	1200	2200	GE-Cage
75	360	220	Ideal-Cage
60	1800	230 D.C.	GE
60*	1200	440	Al. Ch.-Cage

VERTICAL MOTORS—Cont'd.

HP	RPM	Volts	Make
50	1200	2200	Wtg.-Cage
50	600	440	Al. Ch.-Cage
40	1800	220	GE-Cage
40	1700	230 D.C.	GE
40	1200	440	Wtg.-SR
40	1200	2200	Westgh.-BB-Cage
35	1200	2300	Al. Ch.-Cage
35	450	440	GE-Cage
30	1200	dual	Wtg.-Cage
25*	1550	230 D.C.	GE
25	1200	2200	GE-Cage
25	850	230 D.C.	Wtg.
20*	1200	440	Al. Ch.-Cage
20	800	330 D.C.	GE-RC
15*	1800	440	Al. Ch.-Cage
15	1750	110 D.C.	Wtg.
15	1150	230 D.C.	GE
15	600	440	Al.-Ch.
12½	900	220	L. Al.-Cage
10	3400	230 D.C.	Wtg.
7½	1800	500 D.C.	Peerless
7½	900	440	Burke
7½	700	230 D.C.	GE
6	850	110 D.C.	Rel.
5	1400	115 D.C.	R & M.
5	600	440	GE-Cage
4	1650	110 D.C.	Watson
3	3600	dual	Delco
3	1700	230 D.C.	Watson
3	1200	dual	Wtg.-Cage

SYNCHRONOUS MOTORS

HP	RPM	Volts	Make
3000	720	4800	GE-ATI
1015	600	2200	Wtg.-25 cycle
710	720	13200/6600	GE
500	514	440	GE
435	720	2300	GE TYPE ATI
320	900	2300	GE-ATI
250	225	2200	GE-TS
220	600	2300	GE-ATI
200	720	440	GE-TS
200	235	2300	Wtg., rotor & stator only
160	800	440	GE-ATI
150	1800	2200	GE
150	1800	220	GE-ATI, Single Bearing
150	720	440	Westgh.
120	225	220	E-M, rotor & stator only
115	164	208	GE
95	1200	220	Burke
75	1200	220	Westgh.
75	900	2300	GE-ATI-7552
60	360	2200	GE, rotor & stator
50	1200	440	Wagner
50	900	220/440	Westgh.
50	720	440	GE-TS
50	360	440	GE, rotor & stator
30	900	440	Wagner
30	600	550	GE, rotor & stator
30	450	dual	Wtg., rotor & stator
30	360	550	GE
30	327	220	E-N, rotor & stator
25	1800	220	Wagner
25	450	220	E-M, rotor & stator
25	300	220	Ideal
20	1200	440	Wagner
20	900	220	Wtg.
20	600	220	E-M, rotor & stator
15	1800	220	Wagner
15	1200	440	Wagner
10	1800	220	Wagner
10	1200	220	Wagner



D. C. MOTORS

115 Volts

HP	RPM	Description
25	750	GE-MPC
60	1200	Star
25	975	Northern
30	1800	F-M
30	200/600	Sprague
25	1150	Triumph
25	750	GE
20	700	Triumph
20	500/1500	GE-RF11
20	600/1200	GE-RLC fr. 202A
18	600	Sturtevant MPS
15	1200	J. & L.
15	1000	GE-CE
15	975	F-M
15	725	Westgh.-S fr 6
12½	1150	GE-RC29
12	1075	J. & L.
12	580	Westgh.-SK-113
10	3450	Imperial
10	1800/3400	Star, SB-5
10	1200	J. & L.-CI
10	650 & 400/1600	J. & L., type CI Watson-BW15B

SPECIAL SUB-STATION

G. E. Double ended Load Center, Unit Sub-Station complete with:

2—Pyranol Filled, indoor type transformers each rated 1000 KVA, 13800 volts primary, 460 volts secondary, 3 phase, 60 cycle, and each having a liquid filled disconnect switch.

3—G. E., type AL-2, 1600 amp., 50000 amp. RMS, Air Circuit Breakers.

12—G.E., type AE1B, 600 amp. Air Circuit Breakers of draw out type.

Switchgear latest type metal clad.

D. C. GENERATORS

125 Volts

KW	RPM	Description
500	750	GE-MCF
300	1500	GE-CC
200	900	GE-MPC
200	800	GE-DMC
100	1000	WE-DLC
100	900	C-W-CCD
80	400	J. & L.-G
65	1100	W-E, type ELC-7
55	1000	GE-Type TD
40	600	J. & L.-F Ped. Type
30	1165	GE-DLC
31.25	1400	Westgh.-SK-single bearing

D. C. GENERATORS

230 Volts

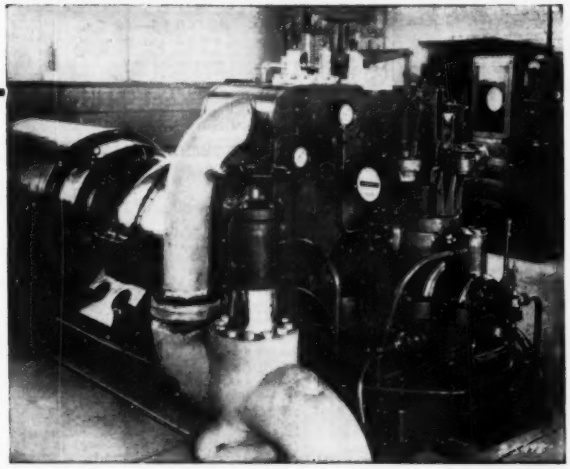
KW	RPM	Description
400	1200	Westgh.
200	1200	GE-MPC
200	375	J. & L.-type K
175	450	Westgh.
125	1400	Westgh.-SK-130L
80	1050	GE-DLC
75	1400	Burke
75	700	Allis-Chalmers-E180
50	1200	Al. Ch.-E-127
35	1800	GE-RC
30	900	Triumph
22½	765	Westgh.-SK
18	900	Burke
15	350	Westgh.-SK

AC & DC MOTORS • GENERATORS • PUMPS
SYNCHRONOUS MOTORS • CONTROL EQUIPMENT
MOTOR GENERATOR SETS • ELECTRIC EQUIPMENT
STEAM ENGINE GEN. SETS • SLIP RING MOTORS

ELECTRIC CO.

927 HARRIET ST.
PHONE MA. 3024
CINCINNATI 3, OHIO

Generate Your Own Power With "UTILITIES APPROVED" EQUIPMENT



Greater Values—Prompt Delivery

STRICTLY UTILITY, EFFICIENT WESTINGHOUSE CONDENSING STEAM TURBO-GENERATOR UNIT

AVAILABLE IMMEDIATE SHIPMENT

Westinghouse, 3600 RPM condensing steam turbo generator unit consisting of:

TURBINE

1500 KW, 250 P.S.I., 150° S.H. 28 inch vacuum direct connected to:

ALTERNATING CURRENT GENERATOR

1875 KVA, 1500 KW, 80% P.F. 3 phase, 60 cycle, 2400 volt 451 Amp. complete and equipped with:

ACCESSORIES

2700 square foot Westinghouse surface condenser, condensing auxiliaries, piping, valves, duplicate exciter sets, switchboard panels and instruments.

EXCELLENT CONDITION

TURBINE-GENERATOR UNITS

3 phase, 60 cycle

6250 KVA G.E. condens., 5 stage, 2300/4000 volts, 200# pressure, 600°TT, 3600 RPM, complete with exciter, switchboard and surface condenser.

5000 KVA G.E., non-condensing Automatic Extraction, 3 phase, 60 cycle, 13,800 volts, 600# P.S.I., 750°TT 150# extraction and 25# gauge back.

3125 KVA G.E. condensing 175/200 P.S.I. 2300 volt, 500°TT, 3600 RPM complete panel.

1875 KVA G.E. non-condensing 150# pressure, 30# gauge back, good for maximum 280#, 650°TT, 480 volts, 3600 RPM, switchboard, complete installation.

1563 KVA G.E. non-condensing 250 P.S.I. 25# gauge back, 2400 volts, 3600 RPM.

1563 KVA G.E. condensing 250 P.S.I. 2300 volts, 3600 RPM complete.

925 KVA G.E. non-condensing 150 P.S.I. 15# gauge back, 480 volts, 3600 RPM complete installation.

625 KVA Westinghouse condensing 150/200# pressure, 2300 volt, 3600 RPM complete.

625 KVA G.E. non-condensing 150# pressure, 15# back, 2300 volts, 3600 RPM complete.

375 KVA (4) G.E. condensing 400# pressure, 2300/4150 volts each complete exciter, switchboard, condenser.

112 KVA Allis non-condensing 150 P.S.I. 10# gauge back, 240 volts, 3600 RPM complete.

100 KVA Westg. non-condensing 125 to 150 lbs. pressure, 10# gauge back, 2400 volts.

TURBINE-GENERATOR UNITS

Direct Current

400 KW (2) 240 volts direct current Crocker-Wheeler Worthington 440 lbs. pressure condensing.

150 KW (2) 3 wire, 250 volts, 225/250 psi, Westinghouse-Worthington condensing.

75 KW Allis-Chalmers-Terry, 125 volts, 2400 RPM, 150 lbs. pressure non-condensing.

60 KW (3) new Westinghouse 120 volt, 200# pressure, condensing.

SYNCHRONOUS MOTORS

1500 KVA Westg. 3 phase 60 cycle, 2300 volts, 900 RPM synchronous condenser complete.

300 HP 80% P.F. G.E. type ATI, 2300 volts, 720 RPM synchronous motor.

900 HP Allis, 3 phase, 60 cycle, 2200 volts, 150 RPM synchronous motor.

MOTOR GENERATOR SETS

1500 KW Allis-Chalmers 550/600 volts, 300 RPM direct current generator direct connected 2190 HP, 3 phase, 60 cycle, 4000/6600 volts synchronous motor.

500 KW General Electric 600 volt DC, direct connected to 710 HP, 3 phase, 60 cycle, 2300 volt, 720 RPM synchronous motor.

400 KW General Electric 275 volt DC, direct connected to 710 HP, 3 phase, 60 cycle, 2300 volts, 720 RPM synchronous motor.

300 KW Allis-Chalmers, 250 volt DC generator direct connected to a 430 HP Allis-Chalmers, 3 phase, 60 cycle, 440 volt, 1200 RPM synchronous motor.

62½ KVA G.E., 3 phase, 60 cycle, 2300 volt, 1200 RPM alternator direct connected 75 HP, 125 volt DC motor.

50 KW Westg. 125 volt, 1200 RPM direct current generator direct connected 75 HP, 3 phase, 60 cycle, 2300 volt motor.

ROTARY CONVERTERS

500 KW (2) 6 phase, 60 cycle, 600 volts direct current, 1200 RPM West. sy. converters.

2000 KW, 6 phase, 25 cycle, 270 volts, 7410 amps., D.C., 300 RPM West. rotary.

STEAM ENGINE-GENERATOR UNITS

Direct Current

400 KW G.E. 240 volts, 360 RPM generator connected to Skinner Unaflow vertical non-condensing engine, 150 lbs. pressure, 10 lbs. gauge back.

275 KW Westinghouse 250 volt, 350 RPM generator connected Ames vertical Unaflow engine.

200 KW, G.E. 125 volt, 200 RPM generator connected Skinner Unaflow engine.

30 KW (2) G.E. 125 volts, 425 RPM generators each direct connected G.E. vertical engine 125 P.S.I.

STEAM ENGINE-GENERATOR UNITS

Alternating Current—3 Phase, 60 Cycle

750 KVA G.E. 2300/480 volt, 150 RPM generator, connected Skinner Horizontal Unaflow non-condensing engine.

500 KVA G.E. 240 volt, 360 RPM generator connected Skinner Vert. Unaflow engine.

250 KVA G.E. 240 volts, 225 RPM connected Chuse non-releasing engine 150 P.S.I. 10# gauge back.

DIESEL ENGINES

900 HP (10) General Motors, Model 12-567 ATL, 12 cylinders, 744 RPM Diesel engines complete with auxiliaries.

1200 HP (4) Fairbanks-Morse, 8 cylinders, opposed piston, 720 RPM Diesel engines.

UTILITIES MACHINERY CORP.

NATIONAL CITY-EAST SIXTH BUILDING **LONG DISTANCE 422** **CLEVELAND 14, OHIO**

"BREW, WOLTMAN OFFERS"

TURBINE UNITS

1—12500 KVA Al. Ch. Cond. 60 cy. 6900 V. 250-lb. 600 deg. FTT. Surface condenser.
1—8375 KVA Cond. 50 cy. 13800 V. 600-lb. 825 deg. FTT. Surface Condenser & boiler. NEW.
1—5000 KVA G.E. Non-C. 60 cy. 13200 V. 600-lb
2—4500 KVA West. Cond. 60 cy. 6600 V. 200-lb.
1—3125 KVA Worthington Non-C. 60 cy. 2300 V. 150-200 lbs., 40-lbs BP.
1—1875 KVA G.E. Cond. 60 cy. 2300 V. 140-150-lbs.
1—1563 KVA G.E. Ext. 60 cy. 2300 V. 400-lbs. IP, 160-lbs. Ext. Cond.
1—1250 KVA DeLaval Non-C 60 cy. 2300 V. 250-lbs.
1—1250 KVA Allis Cond. 60 cy. 2300 V. 150-200-lbs.
1— 940 KVA Elliott Cond. 60 cy. 480 V. 400-lbs.
1— 187 KVA G.E. Non-C. 60 cy. 480 V. 375-lbs., 100-lbs. BP.
1— 125 KVA West. Non-C 60 cy. 240/480 V. 150-lbs., 5-lbs. BP.
1— 25 KW Allis Non-C. DC 125 V. Exciter Dual drive turbine & motor.

BOILERS

2—508 HP Casey Hedges Bent tube.
1—507 HP Comb. Engr. 400-lb. 620 deg. TT. Oil.
2—350 HP Union Iron Wks. 200-lb. box header. Oil.
2—253 HP B. & W. 225-lb. Bent tube.
2—200 HP Erie Economic 125-lb. Stokers.
1—180 HP Frost 200-lb. Return tubular.

DIESEL ENGINE UNITS

2—1600 HP Fair. Morse 60 cy. 2300 V. NEW gen.
1— 720 HP Amer. Loco. 240 V. D.C.
1— 625 HP Worth. 240 V. 60 cy. gen.
1— 600 HP Fair. Morse 2400 V. 60 cy.
1— 480 HP DeLaVergne 2400 V. 60 cy.
1— 375 HP Worth. 240 V. 60 cy. gen.
2— 240 HP Fair. Morse 2400 V. 60 cy.
1— 150 HP Gen. Motors 3-378A-60-3-480
2— 125 HP Murphy 240 V. 60 cy.

NEW MOTORS STOCK
20 — 200 HP
At greatly reduced prices

SYNCHRONOUS MOTORS—60 Cy.

2—3000 HP G. E. 2300 V. 257 RPM
1—1400 HP G. E. 4150 V. 514 RPM
1— 880 HP G. E. 8600 V. 514 RPM
1— 600 HP G. E. 440 V. 360 RPM
2— 500 HP E. M. 2200 V. 514 RPM
3— 400 HP E. M. 440 V. 600 RPM
1— 350 HP G. E. 440 V. 900 RPM
1— 300 HP G. E. 2300 V. 600 RPM
1— 300 HP West. 2300 V. 900 RPM
1— 250 HP West. 600 V. 180 RPM
1— 250 HP G. E. 550 V. 400 RPM
1— 200 HP G. E. 220 V. 600 RPM

INDUCTION MOTORS—60 Cy.

1—8000 HP Cr. Wh. S/R 2200 V. 695 RPM
1—7200 HP S/R 11000 V. 750 RPM 25 cy.
1—1000 HP G. E. S/R 2200 V. 514 RPM
2— 450 HP West. S/C 4150 V. 360 RPM
1— 300 HP West. S/R 2200 V. 1770 RPM
1— 250 HP G. E. S/R 2200 V. 1800 RPM
1— 200 HP Cr. Wh. S/C 2300 V. 900 RPM
1— 200 HP Cr. Wh. S/C 2300 V. 720 RPM New.
1— 200 HP G. E. S/R 2200 V. 435 RPM
1— 150 HP Cr. Wh. S/C 440 V. 1800 RPM. New.
1— 150 HP Cr. Wh. S/C 440 V. 1200 RPM. New.
1— 150 HP Cr. Wh. S/C 440 V. 900 RPM. New.

MOTOR GENERATOR SETS

2—1500 KW West. 250 V. DC 60 cy.
2—1000 KW G. E. 600 V. DC 60 cy.
1— 500 KW G. E. 250 V. DC 60 cy.
1— 200 KW G. E. 60 V. DC 60 cy.
4— 94 KW G.E. 60 V. DC 60 cy.
1— 75 KW Star 240 V. DC 60 cy.
1— 75 KW West. 125 V. DC 60 cy.
1— 18 KW West. 60 V. DC 60 cy.

ROTARIES—60 Cy.

1—2929/3705 KW Gen. Elec. 225/285 V.
1—2025/2565 KW Gen. Elec. 225/285 V.
2—1500 KW Westinghouse 70 V.
1— 500 KW Westinghouse 250 V.

MERCURY ARC RECTIFIERS

2—4500 KW Ignitron 600 V. DC
1—1850 KW Ignitron 275 V. DC

FREQUENCY CHANGERS

1—12500 KVA G. E. 25/60 cy. 300 RPM
2— 3000 KVA West. 25/60 cy. 300 RPM
1— 2500 KVA G. E. 25/60 cy. 300 RPM
2— 1000 KVA G. E. 25/60 cy. 300 RPM
1— 500 KVA Al. Ch. 25/60 cy. 300 RPM

TRANSFORMERS—60 Cy.

1—2000 KVA G. E. 69000—13800/23900 Y 3 ph.
3— 500 KVA G. E. 66000—13200/6600
3—1000 KVA West. 66000—11000
4—7500 KVA Al. Ch. 33000—13800, 3 ph.
6— 50 KVA G.E. 33000—2300
6— 75 KVA Moloney 33000—2300/6900
3—3750 KVA West. 26400/13200—2400
4— 450 KVA Al. Ch. 25410/44000—13280/13800 Y
3— 250 KVA West. 12000—2300/4150
1—2500 KVA Al. Ch. 13200—2300, 3 ph.
1—2500 KVA Packard 13200—2300, 3 ph.
3—1000 KVA Pittsburgh 13200—2300
1— 750 KVA G. E. 13200—480, 3 ph., Unit Substation
2— 200 KVA G. E. 11500—220/110
3— 200 KVA Moloney 11000—2300
3— 167 KVA G. E. 7200/12400 Y—240/480
1—1500 KVA West. Auto 4000—2300, 3 ph.
3— 250 KVA Al. Ch. 2300—460
3— 20 KVA West. 220—575/287½
3— 7½ KVA G. E. 600—120/240
12— 15 KVA Standard 450/225—117/234
2—27½ KVA G. E. 440—220/110

OIL CIRCUIT BREAKERS

1— 400 A. 73 KV. G. E. FHKO-236 Outdoor
1— 400 A. 73 KV. G. E. FHKO-136 Outdoor
1— 600 A. 73 KV. G. E. FHKO-139 Outdoor
3— 400 A. 37 KV. West. G-II Outdoor
1—1200 A. 25 KV G. E. FHKO-256 Outdoor
2—1000 A. 23 KV Kelman CB-76 Outdoor
4— 600 A. 15 KV. G. E. FHKO-138BB Outdoor

PARTIAL LIST—WE HAVE ALL CLASSES OF POWER EQUIPMENT

BREW, WOLTMAN & CO., INC.
50 Church Street — New York City 7, New York

POWER PLANT EQUIPMENT
Special Offerings

TURBO-GENERATORS

2—New 4000 KW Cond. 2400/4160 V. 750° T.T.
1—3500 KW 2300 V Cond.
1—2500 KW 600 V Cond.
1—2500 KW 2300 V Cond.
1—3000 KW 600 V Cond.
1—2000 KW 600 V Cond.
1—1500 KW 2300 V Cond.
2—1250 KW 2300 V Cond.
1—1000 KW 2300 V Non-C.
2—1000 KW 440 V Cond.
1— 750 KW 600 V Extr.
1— 600 KW 240 V Cond.
1— 500 KW 600 V Cond.
1— 500 KW 240 V Non-C.
1— 400 KW 480 V Non-C.
1— 250 KW 2300 V Non-C.

TURBO-GENERATORS (Continued)

1— 250 KW 240 V Non-C.
1— 150 KW 2300 V Non-C.
1— 125 KW 600 V Extrac.
1— 100 KW 600 V Non-C.
1— 50 KW 220 V Non-C.

TURBINE—Only

1—New 485 HP—3550 RPM 900 PSI.

DIESEL GENERATOR

1—New 1000 KW — 2400/4160 V.

ENGINE GENERATORS

1—500 KW 2300 V Unit.
1—400 KW 125 V Unit.
1—375 KW 2300 V Unit.
1—312 KVA 450 V Unit.
1—219 KVA 450 V Unit.
1—168 KW 220 V Unit.
1—168 KW 550 V

BOILERS

2—40,000# 200#
2—30,000# 425#
1— 623 HP 450#
1— 487 HP 200#
1— 300 HP 200#
1— 220 HP 160#
1— 200 HP 175#
6— 200 HP Sterling 160#
2— 190 HP 160# NEW

AIR COMPRESSORS

1—6000 CFM 50# Motor
2—5600 CFM 50# Motor
1—4500 CFM 100# Motor
1—1300 CFM 100# Motor
1—6000 CFM 5.1# NEW
1—5000 CFM 10# Rotary Type Motor

Write or wire for additional data and prints.

A. LEE ELLIS CO., U. S. Machy. Bldg., 140 Federal St., Boston 10, Mass.

The Buyers Must Be Satisfied—Always

MOTOR GENERATORS

1—500 KW G.E. Syn. 600 V. DC. 900 RPM 440/2300/4000 V. AC. 3 P., 60 C.
1—400 KW West. Syn. 600 V. DC. 720 RPM 2300/4000 V. AC. 3 P., 60 C.
2—300 KW G.E. Syn. 250 V. DC. 1200 RPM 440/2300/4600 V. AC. 3 P., 60 C.
1—150 KW G.E. Syn. 250 V. DC. 1200 RPM 2300/4000 V. AC. 3 P., 60 C.

SYNCH. CONVERTERS

1—300 KW G.E. 600 V. 6 P., 60 C., 1200 RPM. 2300/4000/6900/13,200 V. Trans.

WALLACE E. KIRK COMPANY
502 Grant Building, Pittsburgh, Pa.

asme—BOILERS—nat'l. b'd.
4—404 HP sectional header oil burners
3—600 HP Integral Furnace West. stokers complete plant Thermix stacks, 1942
2—600 HP Stirling type low head spreader stokers complete plant 1942
3—84" suspended HRT single settings
Capacities based on 100% rating
HARRY BREARLEY
34-23—91st Street, Jackson Heights, N. Y.

AVAILABLE FOR IMMEDIATE DELIVERY FROM STOCK

POWER PLANT EQUIPMENT

STEAM ENGINE GENERATOR SETS

2—575 KVA Skinner Unaflow—West. 240/480 V.
1—575 KVA Allis-Chalmers Corliss—220/440 V.
1—375 KVA Ames Vertical 220/440 V.
1—250 KVA Ridgeway four valve 2300 V.
1—187 KVA Ames Vertical 220/440 V.
1—156 KVA Ames Vertical 220/440 V.

STEAM TURBINE UNITS

Complete 2000 KW Turbo-Generator Plant:
1—1500 KW G.E. condensing—3600 RPM
1—500 KW G.E. condensing—3600 RPM
These units are of modern design, are 3 phase, 60 cycle, 2300 V.

DIESEL GENERATING UNITS

4 Diesel Generating Units, like new, comprising a complete diesel power plant, and consisting of two 450, one 300, and one 150 HP Fairbanks-Morse model 32-E engine-generator units. Engines are of all duplicate cylinder size, 2400/4160 V. 3 phase, 60 cycle. Late model Woodward governors, pumps, cooling tower, etc. Operated only a short time. Available for immediate delivery.

1—250 KVA—220/440 V. G.M. "twin"—NEW—not war surplus.

BEESON ENGINEERING CO.
1628 E. 7th St., Los Angeles 21, Cal.
MUtual 9151

MOTORS TRANSFORMERS

1—300 KW G-E Rotary Converter 3/60/440 (transformers for 2300) 250/275 v. DC, 900 RPM; w/control

2—60 HP 1200 RPM *NEW WHSE* CS 3/60/440 BB Fr 505. List less 40%

6—100 HP 1800 RPM Rebuilt G-E KT 543 3/60/440

3—125 HP 1200 RPM Rebuilt Elec. Machy. SYN. Type BRKT Unity P.F. 3/60/440

175—3 HP 10.3 RPM Unused G-E Elevator Gear Motors 3/60/220/440 Tot. Encl., 15 MIN., w/brake, shaft 3 1/8" diam.

6—333 KVA 13,200-440 v. Wagner transformers Type 12 ROC 1/60, OISC, w/taps.

C & S MACHINERY COMPANY
715 Howard St. St. Louis 6, Mo.

FOR SALE

Power plant equipment. Steam, Diesel, electrical, boilers, engines, turbines, generators, new or used.

PENN MACHINERY COMPANY
Jackson, Miss.

50,000 lb. Integral Furnace 400 lb. B & W boiler superheater air heater pulverizer fans accessories
2500 KW 2400 volt GE Cond. turbine unit.
1500 KW 480 volt GE NonCond Turbine set.
283 KVA 240 volt Chuse Uniflow engine set.
200 KVA 480 volt Ridgway 4 valve engine set.
200 KW G. E. M. G. Set 2200 AC 250 DC.
50 KW G.E. M. G. Set 220/440 AC 250 DC.
HOWARD B. JOHNSON & ASSOCIATES
53 W. Jackson Blvd. Chicago 4, Ill.

ELECTRICAL EQUIPMENT - REBUILT and GUARANTEED

MOTORS—GENERATORS—MOTOR-GENERATORS—TRANSFORMERS—CONTROLS

PROMPT SHIPMENT — PARTIAL LISTING

VARIABLE VOLTAGE DRIVES
40 HP Reliance Variable Voltage Drives, each Consisting of:
1—40 KW 250 Volt, Induction M-G Set, with two auxiliary 5 KW generators and exciter.
1—40 HP 400/1500 RPM, Frame 365T, 230 Volt, DC Motor.
With full magnetic control providing jog forward, jog reverse, run, fast, slow, and stop, and motor operated field rheostat.

SLIP RING MOTORS—3 Ph., 60 Cy.

Qn.	H.P.	Speed	Volts	Make	Type
6	7½	810	550	G.E.	MTC-5201
1	7½	575	220	G.E.	MT-522
2	10	1140	440	West.	HP-7A
2	10	870	220	G.E.	HT-11
2	11‡	820	550	G.E.	ITC-5008
2	15	1160	440	West.	CW-464C
2	15	870	220	West.	CW-846
1	18	880	440	West.	MW-316
1	20	880	440	West.	CW-838
1	25	1130	550	G.E.	MT-323
2	25	850	220	Wagner	WR
2	25	720	440	Wagner	22VBR
1	30	885	440	West.	CW-646
1	30	850	440	G.E.	MT-332
1	30	675	440	G.E.	MT-336
2	35	600	440	F-M	HV-H16A
2	40	885	2200	Al-Ch.	ARY-223C
1	40	850	440	G.E.	MT-346
2	50	1150	440	G.E.	M-536
1	50	860	440	West.	HF-12A
1	50	850	440	G.E.	MT-552
5	52‡	550	220	G.E.	IQC-5013***
1	60	885	440	West.	CW-758
1	60	850	440	G.E.	MTC-5546
1	60	345	550	West.	CW-838
1	80‡	575	440	G.E.	MTC-5352
2	125	430	440	G.E.	IL-16
2	150	1750	440	G.E.	MTP-549
1	175	505	550	West.	CW-1002
2	200	600	550	G.E.	IM-17
2	200	495	2200	G.E.	IM-17A
3	300	900	140	G.E.	IM-17
2	300	880	2200	G.E.	IM-17A
4	350	1775	2300	G.E.	IM-F15A
2	350	880	2200	G.E.	IM-17A
1	400	505	550	West.	CW
1	600	1770	440	G.E.	IM-F15C
1	650**	580	440	G.E.	MT-442Y
1	700	735	4000‡‡	West.	CW

220 volt motors can be reconnected for 440 volts.
‡Intermittent rating. **2 phase.
***New. ‡‡25 Cycle.

230 VOLT CONST. SPEED D. C. MOTORS

Qn.	H.P.	Speed	Make	Type
20	2	850	West.	SK-20
7	3**	1150	Al-Ch.	EB-71
10	3	850	Reliance	Y-23T
25	3½	850	West.	SK-30
1	7½	1150	G.E.	CDM-66
3	7½	850	G.E.	CD-75
16	10**	1750	Kimble	BA-324
5	10**	1150	Al.-Ch.	EB-80
2	10	850	West.	SK-83
10	13½**	600	West.	SK-93
3	15	1750	G.E.	CD-75
6	15	825	West.	SK-90
1	20	1750	L.A.	ONA-L851
1	20	1750/1810	West.	SK-83
2	20	1150	G.E.	RC-30
11	20	750	West.	SK-110L
17	25	825	West.	SK-120
1	30	1100	G.E.	RC-12
1	40	1700	West.	SK-103
1	40	750	G.E.	RC-34
1	50	750	West.	SK-150
1	50	650	G.E.	RC-16
1	60	1750/1310	West.	SK-143
1	150	700	Al.-Ch.	
2	200	1150	G.E.	RC-38
1	250	1150	C.W.	CMC-101A

230 VOLT ADJ. SPEED D.C. MOTORS

Qn.	H.P.	Speed	Make	Type
10	1½/2	500/2000	G.E.	CD-65
1	2	225/900	Reliance	78T
1	5	450/1800	G.E.	CD-83
2	6	450/1800	G.E.	RF-9
6	5/7½	600/1800	G.E.	RA-30
1	10	400/1600	Reliance	T-92T
2	10/15	600/2400	Reliance	T-92T
1	12½	700/1800	West.	SK-120
10	12½**	600	West.	SK-93
1	15	600/1200	West.	SK-100L
1	20	500/1500	G.E.	RF-11
1	20/25	400/1600	Reliance	T-230-T
1	20/25	300/1200	West.	SK-153
1	25	400/1600	G.E.	RF-13
1	25	500/1500	G.E.	RF-12
1	23/29	300/1200	G.E.	RF-13
1	30	400/1200	West.	SK-163
1	30/40**	500/1500	G.E.	CD-1236
1	35	500/1500	West.	SK-143
1	40/50	400/1200	Reliance	T-461T
1	75	500/1500	Cr.-Wh.	CCM
1	75	375/750	Cr.-Wh.	CMC-125H
3	100	225/900	G.E.	MPC-A
5	100	400/1200	Al.-Ch.	
1	100	520/960	West.	SK-200
1	125	450/1000	West.	SK-190
1	175	230/500	West.	SK-220
2	370	350/600	G.E.	MPC

**New.

SQUIRREL CAGE MOTORS—3 Ph., 60 Cy.
Totally Enclosed Fan Cooled, Ball Bearing

On.	H.P.	RPM	Volts	Make	Type
1	5	3480	220	G.E.	K-225
2	5	1750	440	L.A.	JA-254
10	5	1730	440	G.E.	K-254
2	5	1165	440	L.A.	JA-284
5	7.5	1740	440	G.E.	K-284
1	10	3480	440	West.	CS-324
1	10	1140	440	Wagner	CP2-326
1	10**	880	220	West.	CS-365-EXPF
1	15	1745	440	West.	CS-326
1	15	1175	440	L.A.	JA-365
1	20	1760	220	G.E.	K-364
1	25	1760	220	G.E.	K-365
1	25	1200	550	G.E.	K-405
1	25	1170	220	L.A.	JX-405
1	25	705	440	West.	CS-W504
1	40	3565	440	G.E.	KF-4038

Splashproof, Ball Bearing

On.	H.P.	RPM	Volts	Make	Type
23	5	1750	440	L.A.	FS-254
1	5	1735	220	G.E.	K-254
1	5	1160	440	L.A.	FX-284
1	10	3480	440	G.E.	K-284
1	15	1175	440	L.A.	JA-365
4	15	1150	440	L.A.	FX-365
2	40	1175	220	G.E.	K-445
3	50	1760	440	L.A.	FX-445A
5	50	1160	220	G.E.	K-504
1	125	1770	440	L.A.	FX-1078Y
1	150	1775	440	L.A.	FX-1168
3	150	880	440	L.A.	FX-1368
1	150	700	440	G.E.	KF-6335
1	200	885	440	L.A.	FS-1378

Open Type Motors

On.	H.P.	Speed	Volts	Make	Type
1	2	690	440	G.E.	KT-944
10	5	1740	440	West.	CS-232C
1	7½	3475	440	West.	CS
1	7½	1750	440	West.	CS-250C
3	7½	1165	440	G.E.	KT-952
2	7½	870	440	West.	CS-370C
5	10**	1760	440	L.A.	OGA-324
5	10**	1750	440	West.	CSP-324
3	10	1160	440	West.	CS-370C
1	10	865	440	G.E.	KT-502
1	15	3485	220	Reliance	AA-B3247
5	15**	1735	440	Century	SC326
1	15	1200	220	G.E.	KT-502
1	15	1200	220	G.E.	FTR-512
1	20**	3475	220	West.	CS-326
5	20**	1750	440	Wagner	RP1-364
1	20	1750	220	West.	CS-W364
1	20	1200	220	G.E.	KF-512
2	20	1160	440	West.	CS-464C
2	20	900	220	C.E.	FTR-522
1	25	1800	220	G.E	KT-312
5	25**	1740	440	Century	SC-364
1	25	1160	440	West.	CS-667C
1	25	900	220	Howell	SCRH-356***
2	25**	875	440	Master	PB-405
2	25	575	440	G.E.	KT-542
3	30	3550	550	G.E.	K-3648
1	30	1160	440	West.	CS-444
1	30	870	220	West.	CS-446
1	40**	3545	220	G.E.	KF-4048
2	40	1750	440	West.	CS-585C
2	40	900	2300	G.E.	FTR-536
4	50**	1750	440	Wagner	RP5-405
1	50	850	220	West.	CCL
1	60**	1750	440	Ideal	AH-444
2	60	900	440	G.E.	KT-346
1	75	1160	440	West.	CS-662C
1	75	870	220	West.	CS-766A
2	75	865	2300	G.E.	KT-352
1	100	690	220	West.	C
1	100	580	2200	G.E.	IK-15A
2	100	500	2200	West.	CS-930
1	100	495	2200	A1.-Ch.	AN
2	125	435	440	A1.-Ch.	AR
2	125	900	2300	G.E.	I-17-FR
1	200	580	5501‡	G.E.	KT-5668
1	500	1200	440	G.E.	KTP-567
1	700	1800	2300/4000	West.	CS-4-29D-12

220 volt motors can be reconnected for 440 volts.
**New ***2 Phase.
‡‡ Reconnectable for 440 volts.

MOTOR GENERATOR SETS
125 and 250 Volts D. C.
(Write for complete Specifications)

KW	Make	RPM	D.C.Volts	A.C.Volts
2	Cont.	1750	125	220/440
7.5**	West.	1455	125	380/220†
10	West.	1750	125	220/440
10	West.	1450	125	220/440†
10	West.	1150	250	220/440
15**	G.E.	1800	125	220/440
15	G.E.	1755	250	220/440
15	West.	1450	125	220/440†
16	West.	1750	125	2200/440
20	West.	1750	250	220/440
25	G.E.	1800	250	220/440
25	G.E.	1200	125	220/440
30	G.E.	1800	250	220/440
30	Al-Ch	1750	125	220/440
50	West.	1750	250	220/440
50	G.E.	720	125	220/440†
75	G.E.*	1200	125	220/440
75	G.E.	1200	250	2300/440
100	Columbia*	1200	250	2300/440
150	West.*	1200	250	2300/440

Note: 3KW, 5KW and 7.5 KW, 250 Volt Sets Also Available.
**New *Synchronous Motor Driven.
†50 Cycle ‡25 Cycle.

Above Items Represent a Partial Listing Only. Your Inquiries Will Receive Our Prompt Attention. All Equipment is Located in Our Cleveland Warehouse. We Have Controls for Most Items Listed.

ELECTRIC GENERATOR & MOTOR CO.
[illegible] HAMILTON [illegible] CLEVELAND 13, OHIO

POWER PLANT MACHINERY

CONDENSING TURBO UNITS

3 phase 60 cycle

25000 KVA G.E., 13800 volts, 400# steam.
6000 KVA (2) G.E., 4000 volts, 600# steam.
2250 KVA G.E., 2300 volts, 400# steam.
1875 KVA Allis, 480 volts, 400# steam, 150# extraction.
1563 KVA G.E., 2300 volts, 225# steam.
1563 KVA G.E., 2300 volts, 400# steam, 160# extraction.
1560 KVA Allis, 240 volts, 180# steam, 5# extraction.
1250 KVA G.E., 4000 volts, 400# steam.
1250 KVA G.E., 2300 volts, 200# steam, 5# extraction.
937 KVA Allis, 480 volts, 150# steam, 5# extraction.
750 KVA G.E., 480 volts, 200# steam, 15# extraction.

NONCONDENSING TURBO UNITS

3 phase 60 cycle

5000 KVA G.E., 13800/6900/4000 volts, 600# steam, 150# extraction, 50# exhaust.
1563 KVA G.E., 2400 volts, 250# steam, 20# exhaust.
937 KVA G.E., 480 volts, 200# steam, 20# exhaust.
625 KVA G.E., 240 volts, 175# steam, 5# exhaust.
375 KVA G.E., 240 volts, 150# steam, 10# exhaust.
250 KVA (2) G.E., 480 volts, 150# steam, 5# exhaust.

BOILERS

40,000# per hour Vogt, 450# steam, chain grate stoker.
22,500# per hour (2) combustion engineering, 450# steam, chain grate stoker.
18,000# per hour Erie City, 200# steam, spreader stoker.
250 H.P. B & W Sterling, 175# steam, chain grate stoker.

UNIFLOW UNITS

3 phase 60 cycle

750 KVA Skinner, 2300 volts, 160# steam, 5# exhaust.
625 KVA Skinner, 240 volts, 150# steam, 5# exhaust.
625 KVA Ames Vertical, 2300/480/240 volts, 150# steam, 5# exhaust.
500 KVA Skinner, 450 volts, 130-160# steam, 5# exhaust.
312 KVA Skinner, 480 volts, 115-140# steam, 5# exhaust.
250 KVA (2) Skinner, 450 volts, 160# steam, 5# exhaust.

MOTOR GENERATOR SETS

3 phase 60 cycle

500 KW G.E., 125/250 volts DC, 2300 volts AC, synchronous.
500 KW G.E., 275/550 volt DC, 2300 volts AC, synchronous.
200 KW G.E. 125/250 volts DC, 2300 volts AC, synchronous.
60 KW G.E., 125 volts DC, 440 volts AC, induction.

INTERNATIONAL POWER MACHINERY CO.

UNION COMMERCE BLDG. Telephone: MAin 9514 CLEVELAND 14, OHIO

MOTORS • GENERATORS • TRANSFORMERS

MOTORS

3 PHASE—25 CYCLE—220/440 VOLTS

H.P.	Make	Type	Frame	RPM
50	Fairbanks Morse	H16B	Ball Bearing	750
75	Fairbanks Morse	H18C	B.B. Slipring	750
75	Gen. Elect.	1K	2200 volt	750
75	Gen. Elect.	1K		1500
100	Allis Chalmers			1450
150	Gen. Elect.	1K-17		365
150	Gen. Elect.	1K-16		480
150	Gen. Elect.	1M-16	Slip Ring	480
150	Allis Chalmers			1450
150	Gen. Elect.	KT	557	1455
400	Gen. Elect.	1M 17A	Slip Ring	730
800	Gen. Elect.	1K		485
600	Gen. Elect.	MT	Slip Ring	490
600	Westinghouse	CB		490

INDUCTION HEATING SET

GENERATOR—175 KVA General Electric A.C. Generator, type A.S.C. form AL, single phase, 800 volts, 2800 cycle, 1400 RPM, serial #5513639.

GENERATOR EXCITER—1 KW, General Electric Generator, type EE, form EB, 125 volts, D.C., 1800 RPM, 8 amps., serial #1758709.

MOTOR—300 HP General Electric synchronous motor, type TS, form EL, .8 P.F. 3 phase, 60 cycle, 440 volts, 1800 RPM, serial #5513638.

MOTOR EXCITER—3 KW, General Electric Generator, type EF, form EB, 125 volts, DC, 1800 RPM, 24 amps. serial #1758730.

Motor and Generator are direct connected, 4 bearing. Mounted on factory fabricated base, with direct connected exciters.

3000 Cycle Control is mounted in cubicle also containing 300 HP General Electric synchronous motor starting control.

3 PHASE 550 VOLTS 25 CYCLE MOTORS

Write for our stock list of approximately 500—3/25/550 Voltmotors

SLIPRING MOTORS

3 Phase—60 Cycle—220/440 Volts

H.P.	Make	Type-Frame	Speed	Remarks
2— 20	LA1	KH	900	
20	G.E.	MT-303	1800	
30	Cr. Wh.		1800	
3— 35	West.	CW	585	
35	G.E.	MT-342	690	
35	West.	MW	680	
40	West.	CW-748A	690	
6— 40	G.E.	MT-336	1200	
40	G.E.	MT-523	1800	
50	G.E.	MT-536	1200	
50	G.E.	MT-527	1800	
2— 50	West.	CW	1800	
60	G.E.	MT-533	1800	
60	West.	CW-653C	1800	
100	West.	CW	435	3 bearing
2—100	G.E.	I form M	900	
2—100	G.E.	MT-347	1800	
125	G.E.	I form M	1200	
2—250	G.E.	I form M-16	900	
350	West.	CW	425	2200 volts
500	Al. Ch.	ANY-WR	514	2200 volts
600	G.E.	MT	490	25 cycle
This motor will rewind satisfactorily to				
700	G.E.	MT	720	

HORIZONTAL & DUPLEX Compressor & Vacuum Pumps after Coolers, Filters

60 CYCLE GENERATOR

1—45 KW Gen. Elec. Generator Type A.T.B. 8 PF. 3 phase 60 cycle 2300 volts 1200 RPM. Serial No. 4313990 with direct connected exciter and panel boards.

FREQUENCY CHANGERS

All Sizes in Stock. 60 cycle to 90 cycle, 100 cycle, 120 cycle, 180 cycle and any other high cycle.

NEW TRANSFORMERS

3—25 KVA Niagara O.I.S.C. 2400/120/240 1 Phase 60 cycle with taps.
3—37½ KVA Niagara O.I.S.C. 2400/120/240 1 Phase 60 cycle with taps.
6—50 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—75 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—100 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—100 KVA Niagara O.I.S.C. 2400/120/240 1 Phase 60 cycle with taps.
3—150 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—200 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—250 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.
3—333 KVA Niagara O.I.S.C. 2400/240/480 1 Phase 60 cycle with taps.

100 KVA TRANSFORMERS

3—100 KVA Gen. Elec. Transformers. Type H Form KF—2400/4160 volts primary 120/240 volts secondary. Price $450.00 each. Electrically O. K. F.O.B. truck, Minnesota.

3—200 KVA Westinghouse Transformers, 1 Phase 25 cycle 2300 volts Primary 230 volts Secondary—Guaranteed.

SPECIAL OFFERING

200 KW Westinghouse NEMA Frame Generator 250 Volt DC, 1200 RPM, direct connected to
300 HP Westinghouse Synchronous motor 3/60/208/1200 RPM, A.C.—D.C. Panels—Like New

Immediate Shipment.

Write for complete listings of 60 cycle—25 cycle—DC motors and controls.

ERIE ELECTRIC CO., INC.

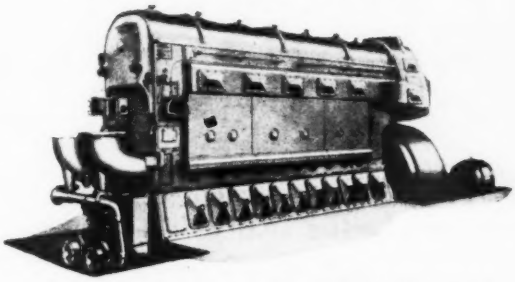
124 CHURCH ST. BUFFALO, N. Y.
CL. 4758

DIESEL POWER PLANT EQUIPMENT

NEW and USED

Our stock is large and includes almost anything wanted in Diesel Power

Send us your specifications



Always get Charles Weaver's prices before buying

They will save you many dollars

Also on Turbine-Generators and Boilers

Above Cut Shows Fairbanks-Morse Latest Model 1600 HP., 38D8 1/8 Opposed Piston Diesel Engine, with New (never used) A.C., 1250 KVA. 3/60/2300/4160-v. Generator with Direct Connected Exciter, Etc.

SPECIALLY ADAPTED FOR MUNICIPAL AND ALL STATIONARY INSTALLATIONS: ASK FOR CITIES NOW USING THIS DESIGN

A FEW OTHER DIESEL POWER UNITS IN OUR STOCK:

6—Hamiltons, 1600-HP., 720-RPM., with West. Reversing Reduction Gears: SAME AS NEW: 15—Baldwin-Westinghouse 300-KW, DC., 240-v., 400-RPM.: 4—GM. Model 3-268-A, 100-KW. 4—FM. OP., 1200-HP., 720-RPM., Engines, 8-cyl. Nearly New. AND MANY OTHERS. Write Us. Giving Specifications.

Telephones
Woodward 1-1340
Woodward 1-1341
Woodward 1-6038

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4145 PENOBSCOT BLDG.
DETROIT 26, MICH.

OUR SLOGAN
Good Equipment
Immediate Deliveries
Right Prices

BULLETIN 320 IS FREE. SEND FOR IT

Compressors — Vacuum Pumps
New and Guaranteed Rebuilts
Save 40% to 60%

SPECIALS
270 CFM 125# SULLIVAN "UNIT AIR"
616 CFM 125# INGERSOLL XCB-2
877 CFM 125# INGERSOLL XCB-2

PORTABLE COMPRESSORS
OILLESS FOR INSTRUMENT CONTROL
66 CFM—6x5 INGERSOLL ER-1
89 CFM—6x7 INGERSOLL ES-1
93 CFM—7x8 INGERSOLL ER-1
173 CFM—9x8 CHICAGO PNEU

MANY OTHER MAKES AND SIZES AVAILABLE—LIST 147

AMERICAN AIR COMPRESSOR Co.
Dell Ave. & 47th St., North Bergen, N. J.

TRANSFORMERS
FOR SALE

2—150 KVA. 60 CY. 1 PH. 2400-240/480 SCOTT TAPS.
6—100 KVA. 60 CY. 1 PH. 2400-240/120.
6— 75 KVA. 60 CY. 1 PH. 2400-240/120.
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3—2,000 KW same as above } Also 400 & 600# Turbes
2—1,500 KW same as above
2—1,250 KW same as above
2—1,000 KW same as above
1—500 KW same—Also 750 KW & 300 KW Units
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100 KW DC 240/120 V., 417 Amps. 1200 RPM Motor: Superior, 150 HP Model GDB-8 8 cyl., Electric starting.

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AT REDUCED PRICES!

NEW SLIP RING
220/440 VOLTS

Qu	HP	RPM	Mfg.	Shaft
1	100	720	Elliott	3⅞x 6
2	125	720	Elliott	4 x12
1	150	720	Elliott	4 x12
2	500	1200	Elliott	4½x 8

All sealed sleeve bearings, on original skids.

New control available for each motor.

Reconditioned and guaranteed

SLIP RING

HP	RPM	Volts	Mfg
500	450	2300	G.E.
450	514	440	Whse.
400	514	2300	Allis
350	450	2200	Whse.
300	600	2200	Whse.
250	600	440	G.E.
200	1200	440	G.E.
150	1200	2300	G.E.
100	600	440	G.E.
75	1800	220	G.E.
75	450	440	Allis
60	900	220	G.E.
50	1200	220	G.E.
30	1200	440	G.E.

M. G. SETS

600 KW MG SET

250 volts D.C. 440 volts A.C., G.E., with syn. motor. Complete with control. Nearly new.

KW	DC volts	AC volts	Mfg
1000	250	4160	G.E.
500	250	2300	G.E.
400	250	2300	G.E.
300	250	2300	G.E.
250	250	2300	C-W
200	250	2300	Whse
200	250	440	G.E.
150	250	440	G.E.
100	250	440	Star
75	250	440	Star
50	250	220/440	Rel.
30	250	220/440	Rel.

Reconditioned and guaranteed

SYNCHRONOUS

HP	RPM	Volts	Mfg	Type Engine
650	138	2300	Whse.	
600	450	2300	G.E.	80%
500	120	2300/4000	E-M	80%
500	600	2300/4160	G.E.	80%
500	514	440	E-M	100%
400	720	440	G.E.	80%
350	900	440	G.E.	100%
300	514	440	G.E.	100%
250	600	4160	E-M	100%
150	900	4160	G.E.	80%
75	900	220	E-M	80%

NEW DIRECT CURRENT
230 VOLTS

Qu.	HP	RPM	Mfg	Frame
3	3	690/2660	G.E.	284
15	5	850/1700	G.E.	CD-66
5	7½	515/1750	G.E.	CD-77
4	7½	575/1750	Rel.	T-46
3	10	1750/2200	Rel.	T-34
5	30	850/1700	Rel.	T-230
2	75	400/1200	Rel.	T-651
2	75	1750	E-M	1509
1	250	1750/2300	C-W	

All ball bearing—drip proof.

Reconditioned and guaranteed

DIRECT CURRENT
230 volts Adjustable Speed

HP	RPM	Mfg
250	400/1200	E-D
200	300/900	Whse.
200	400/1200	Rel.
150	300/900	Whse.
150	400/1200	Whse.
125	400/1200	Rel.
	50-100-600/1200	Rel.
100	500/1500	Whse.
100	300/900	Rel.
75	500/1500	C-W
60	500/1500	Whse.
60	400/1200	Whse.
50	500/1200	Whse.
40	500/1500	L-A
25	400/1200	G.E.

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2—New Twin—Model 671 General Motors 6 cyl. Diesel engines with reduction drive—Price $4800.00 each

1—276 H.P. Buckeye horizontal Twin Cyl. Diesel engine belt drive with 200 K.W., A.C., 3-60-440 volt generator—Price $3300.00

2—Buda 6DCS1879 diesel engine direct connected to 150 K.W. 3-60-440 volt Ideal generator 3 wire—Price $6800.00

1—730 cu. ft. Ing.-Rand type XRB compressor with Western Electric 3-60-220 volt synchronous motor—manual controls—attractively priced—still in service

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3—300 H.P. B & W sect. header, 200#
1—250 H.P. Fitzgibbons self-contained, 125#
1—125 H.P. Erie City Economic, 150#
1—100 H.P. Lucy loco. type, 250#
2— 80 H.P. Erie City Economic, 125#
1— 75 H.P. Leffel Scotch, 125#
All A. S. M. E. Code, in excellent condition

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150 & 200 HP Slip Rg. Motors
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2—600' Syn. Motor Air Compressors
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MOTOR GENERATOR SETS

KW	Make	A.C.	D.C.
1200	Al. Ch.	4000	600
1200	G.E.	5000	125/250
1000	G.E.	440	250
1000	G.E.	2300	250
500	G.E.	440	250
500	G.E.	2300	600
450	G.E.	2300	125/250
300	G.E.	2300/440	250
200	Cr.Wh.	2300	125
150	Al.Ch.	220	125
125	G.E.	440	125
90	G.E.	2300/440	90
75	G.E.	2200/440	125
75	G.E.	2200/440	250
75	Star	440	250
60	Westg.	440	250
60	Al. Ch.	220	110
60	F. Morse	220	125
50	G.E.	440	250
50	Westg.	440	110
40	Cr.Wh.	220	125
40	Westg.	220	125
40	Reliance	440	230
40	Cr.Wh.	440	125
25	Wotton	220	110
15	Westg.	440	250
10	Hertner	220	90/108
10	Reliance	440	250

Smaller sizes to 1½ K.W.

MERCURY ARC RECTIFIER

4500 KW Al. Ch. 600 V. DC to 13800 V primary A.C.—All complete.

FREQUENCY CHANGER

1000 KW G.E. Type ATI, 300 RPM.
25 cy. 3/25/6600
60 cy. 3/60/4160/2400

POWER FACTOR CORRECTOR

M.G. set consisting of
1533 KVA A.C. gen. 3/60/2300-900 RPM 3/60/2200-900 RPM.

SLIPRING MOTORS

H.P.	Make	Type	V.	Spd.
3000	G.E.	I.M.	2200	120
1500	Westg.	H.F.	2300	233
1500	G.E.	M.T.	6600	253
1000	Al. Ch.	ANY	2300	240
800	Westg.	C.W.	6600 - 440	507
750	Westg.	C.W.	2300	900
750	G.E.	M.T.-16	2200	450
600	G.E.	I.M.	2300	600
600	G.E.	I.M.	440	352
500	Ideal	A.V.	2200 - 4000	1800
500	Al. Ch.	ANY	2300	514
400	G.E.	I.M.	2300	900
400	Al. Ch.	ANY	4000	1180
400	Al. Ch.	ANY	4000	514
350	G.E.	I.P.	2300	720
350	Westg.	C.W.	2300	450
300	G.E.	I.M.	2300	600
300	G.E.	I-EA	2300	1750
250	Ideal		440	720
250	Al. Ch.	ANY	2300	300
250	Westg.	C.W.	2300	600
125	G.E.	I.M.	2300	720
100	Al. Ch.	ANY	440	720
100	Westg.	C.W.	440	575
75	G.E.	I.M.	440	1750
75	G.E.	I.M.	440	514
60	Westg.	C.W.	2300	870
50	L.A.	G.H.	440	870
50	G.E.	I.M.	440	1720
35	Westg.	C.W.	440	1200
35	G.E.	I.M.	440	1200
35	F. Morse		440	1800
30	Line. crane		440	900
3	G.E.	M.T.	2200	1750
30	G.E.	ITC	440	1800
30	G.E.	M.T.	220	900
25	G.E.	M.T.	440	1200
20	Al. Ch.	ARV	440	900
15	Westg.	C.W.	440	900
15	Al. Ch.	ARV	440	900
11	Westg.	MW	440	1100
10	Al. Ch.	ARV	440	900
7½	G.E.	ITC	440	1200

Smaller sizes to 1½ H.P.

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Has a modern up-to-date plant where all equipment is fully and skillfully rebuilt and houses a tremendous stock of . . .

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- Pumps

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600 Amperes, 15000 Volts,
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3 Pole, 125 Volt DC Solenoid Operated,
150,000 KVA I. C.
Angle Iron Frame Mounted.

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SPECIAL
750 GPM Dayton-Dowd Fire Pump 75 HP 3 ph 60 cy 220 V 1750 rpm GE motor.

SQUIRREL CAGE MOTORS 60 CY 3 PH

HP	Make	Type	Speed
275	GE	KF 550	1800
200	GE	I-K	1150
150	West	CS	1800
100	GE	I-K	575
100	A.C.		720
100	GE	KTP	1800
75	GE	I-K	600
75	West	CS	720
75	GE	I-K	720
75	Burke	EM	720
75	A.C.	AR	1800
75	GE	KT	1800
60	West	CS	900
60	Wagner	BR	1200
50	A.C.	AR	600
50	GE	KT	720
50	GE	KT	900
50	West	CS	1200
50	GE	KT	1800
50	A.C.	ARWWX	3600
40	GE	KT	720

SLIPRING MOTORS 60 CY 3 PH

HP	Make	Type	Speed
450	West	CW	500
150	F.M.	HV	1800
100	GE	I-M	1800
60	GE	MT	900

GEARED MOTORS 60 CY 3 PH

HP	Make	Type	Speed
60	West	CS	290
60	GE	KF	427
50	GE	M	233
40	GE	KF	561
30	GE	KF	555
20	West	CS	778
15	GE	KG	563
15	West	CS	875
10	West	CS	440
7½	West	FD	61
7½	Master	PA	318
7½	West	CW	61
5	Reliance	AA	44
5	GE	KG	147
3	Reliance	SB	68/34

HOIST DUTY MOTORS 60 CY 3 PH

HP	Make	Type	Speed
300	GE	MTC	600
60	GE	MTC	600
50	Imperial	W-55	850
40	GE	MTC	1200
10	West	CI	600
10	GE	MTC	1200
7½	West	CI	870

SYNCHRONOUS MOTORS 60 CY 3 PH

HP	Make	Type	Speed
300	GE	TS	720
150	GE	TS	720
145	West		1200
108	GE	TS	1200
50	Elec. Machy.		225
35	GE	TS	1800

230 VOLT DC MOTORS

HP	Make	Type	Speed
150	Cr. Wh.	83H	900
125	A.C.		600
100	GE	CDM	1200
100	Elec Dyn	10SM	1800
50	West	SK	600
50	Burke	WA6S	1450

SPECIAL
TRANSFORMERS 1KVA to 200 KVA. Write for complete list, recently purchased, available at ridiculously low prices.

AC GENERATORS

KVA	Make	Type	Speed
300	GE	ATI	900
200	West		600
219	GE	ATI	257
160	GE		1200
75	Elec. Machy.		900

AC-DC MOTOR GENERATOR SETS

KW	Make	AC	DC
400	Ideal	2300	250/125
100	G.E.	2300	250
75	Cr. Wh.	440	125
60	GE	440	125
60	GE	220	125

SPECIAL
OUR NEW FREE CATALOG NO. 49. Listing thousands of items is now available. WRITE!

SPECIAL
50 Cy 1450 rpm
NEW WESTINGHOUSE MOTORS
Ball Bearing Dripproof, export packed
5—1½ HP—190/380 volts
5—2 HP—190/380 volts
50—3 HP—190/380 volts
25—5 HP—380 volts only

SPECIAL
GASOLINE AND DIESEL ENGINE GENERATOR SETS
from 1 KW to 100 KW
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MOTORS and ELECTRICAL EQUIPMENT

SQUIRREL CAGE MOTORS 3-PHASE, 60-CYCLE

Qu.	H.P.	Make	Type	Volts	R.P.M.
1	400	G.E.	KT-412	2300	450
1	400	G.E.	KT-412	550	450
1	300	Al. Ch.	AR	440	500
1	250	Whse.	CS	2200	1160
1	250	Whse.	CS	440	1160
1	200	Al. Ch.	AR	220/440	580
1	150	El. Mchy.	IC	1200	1200
1	150	Whse.	CS-772	2200	1170
1	150	G.E.	I-K	440	720
1	150	Cr. Wh.		440	600
1	125	Whse.	CS-761	440	1170
1	125	Whse.	CS-772	2200	1170
1	125	Whse.	CS-772	440	1170
2	125	Al. Ch.	AR	440	435
3	100	Whse.	CS-663	440	1750
1	100	Al. Ch.	AR-226	2200	1160
1	100	Al. Ch.	AR-226	440	1160
5	100	F.M.	HS-201C	440	880
2	100	G.E.	KT-556	2200	865
2	100	G.E.	KT-556	550	865
1	100	Al. Ch.	AR	550	690
1	100	F.M.	H-241B	440	433
1	75	Al. Ch.	AR	2200	1765
1	75	Whse.	CS	440	1750
1	75	G.E.	KF-452	440	1200
1	75	Burke	EM-10	550	720

SLIP RING MOTORS—CONSTANT DUTY 3-PHASE, 60-CYCLE

Qu.	H.P.	Make	Type	Volts	RPM
2**	3000	G.E.	I.M.	2200	120
1	2000	G.E.	MT.	2300	240
1	1500	Al. Ch.	ANY	2200	230
1	800	G.E.	MT-12	2200/6600	600
1**	600	G.E.	MT-412-Y	2200	719
1	500	G.E.	I.M.	2300	600
1	500	G.E.	I.M.	550	600
1	400	Whse.	C.W.	440	600
1	400	G.E.	I.M.	2300	875
1**	400	Al. Ch.	ANY	2300	514
1	400	G.E.	MT 422	2300	360
1	300	G.E.	I.M.	2200	1200
1	300	Al. Ch.	ANY	2200	505
1	275	Whse.	H.F.	440	345
1***	250	G.E.	M.T.	2300	600
1	250	Whse.	C.W.-1106	2200	600
1	200	Al. Ch.	ARY	2200	585
1	160	Whse.	C.W.	220/440	690
1	150	G.E.	I.M.	2200	1750
1	150	G.E.	I.M.	440	1180
1	125	Al. Ch.	ARY	440	900
1	75	G.E.	I.M.	220/440	695
2	50	G.E.	MT-536	2200	1150

***—3-bearing
**—MILL Type 2-pedestal bearing on cast iron

TRANSFORMERS (O. I. S. C.)

Qu.	KVA	Make	Type	Phase	Voltage
1	1000	Kuhlman	CSP	3	24000/13800/480
2	750	G-E	HTT	3	6300Y/3601/230
4	500	G-E	H	1	13200/11880/220/440
4	500	Kuhlman	CSP	3	2400/4160Y/480
3	150	G-E	H	1	19800/9500/550/2200
3	100	Whse	SK	1	12075/11500/460/230
3	100	G-E	Auto	1	4500/2400
8	100	G-E	H	1	4160/7200Y/120/240
3	100	G-E	H	1	2400/4800/120/240/480
3	75	G-E	H	1	2400/4160Y/120/240
2	50	Wag.	HE	1	13200/11880/550/287
3	50	Al-Ch		1	22000/220
2	25	G-E	HBA	1	2400/4160Y/120/240
1	25	Whse	S	1	2200/220/110

(WE HAVE MANY SMALLER UNITS IN STOCK. SEND U. I YOUR SPECIFICATIONS)

MOTOR GENERATOR SETS 3-PHASE, 60-CYCLE

Qu.	KW	Make	RPM	Volts D.C.	Volts A.C.
1	1000	G.E.	514	600	4160/2300
1	750	Al. Ch.	720	250	440
1	750	G.E.	514	275/300	4160/2300
1	600	G.E.	720	300	2300/440
1	400	Whse.	710	550	2200
1	300	G.E.	720	250	2300/440
1	200	Burke	720	250	2300/440
1	100	Reliance	1200	275	440
1	100	G.E.	1200	250	2300/440
1	100	Cr. Wh.	720	250	2300/440
2	94	G.E.	1200	62.5	440/220
1	75	Al. Ch.	900	250	2300
1	75	Whse.	1200	120	440/220
1	50	Lo. Al.	1200	120/240	2200/440
2	35	G.E.	1800	125	440/220
1	25	Whse.	1200	120/240	440/220
6	25	Whse.	1200	120/240	440/220
1	15	Al. Ch.	1200	250	440/220
1	9	G.E.	1750	250	440/220

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1—5" x 4" Gould 4 stage, 500 GPM, 1320' hd. 250 HP, 3500 RPM

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Worthington Laidlow, 12½/23 x 22/13 x 16 Duplex 2 stage, serial #L26589, 1500 CFM Displacement. JUST TAKEN FROM SERVICE.

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2—2100 HP, GE Synchronous motors, 514 RPM, 4600/2300 V, 3 phase, 60 cycle, 80% P.F. Complete with rheostats and belted exciters. Full details on application.
2—2000 KVA Transformers—Single phase 60 cycle 69/34.5 KV to 4800/2400 V. Westinghouse O.I.S.C.
1—3500 KVA—3 phase, 60 cycle, 33/13.8 KV Westinghouse Transformer.
1—600 A., 3 P.S.T., 34.5 KV Outdoor O.C.B. Westinghouse CO-1-A.
1—3 pole, 600 A, 34.5 KV Outdoor Disconnect Switch.
Miscellaneous Distribution Transformers, Cable, Switches, Potheads and Electrical Instruments. Also Ross Carrier—hardly used. Arch measurements—91" high and 76" wide. 7 Ton capacity.
All the above are for immediate sale and are located at our Pulp Mill on Vancouver Island.

BLOEDEL, STEWART & WELCH, LTD.

904 Standard Building, Vancouver, B. C.

TURBO-GENERATORS—A.C.

1—1000 KW Allis Chalmers 3/60/600, 3600 RPM, cond., 140# steam press.
2—250 KW G.E. type ATI 3/60/450, 1200 RPM, cond.
2—200 KW Westinghouse, 3/60/450, 1200 RPM cond. (NEW).
6—200 KW G.E. type ATB 3/60/450, 1200 RPM cond. and non cond.
2—132 KW G.E. type ATB 3/60/450, 1200 RPM, cond.

TURBO-GENERATORS—D.C.

KW	Volts	Winding	Speed	Type
2—375	180/240	Shunt.	1200	non-cond.
5—300	120	Compd.	1200	cond.
1—300	240	Compd.	1200	cond.
4—150	120	Shunt.	1200	cond.
12— 60	120	Stab. Sh.	1800	cond.
3— 25	120	Stab. Sh.	1800	cond.

CONDENSERS

Most are new

No.	Sq. Ft.	Make	Passes	Tubes	
4	3300	Str. Wells	2	Alu Brass	3/4"
1	2200	Alco	2	Cu Ni	5/8"
4	1050	Conseco	2	Cu Ni	5/8"
1	700	Bethlehem	2	Brass	5/8"
30	400	All. Chalm.	2	Brass	5/8"
8	155	Conseco	2	Brass	3/4"
44	349	Luboil Coolers		CU Ni	5/8"

Modern Equipment

DIESEL ENGINES

HP	MAKE	MODEL	RPM	CYCLE	YEAR
1800	General Motors	16-258S	900	4	1943
1600	Fairbanks Morse	38D8⅛OP	720	2	1944
1600	Hamilton	RB99-D.A.	700	2	1944
1600	General Motors	16-278A	720	2	1944
1200	General Motors	12-278A	750	2	1944
1200	General Motors	16-184A	1800	2	1943
900	General Motors	12-567ATL	750	2	1942/44
900	General Motors	6051 Quads	650	2	1943
500	Superior	6-cyl.	514	4	1942
300	Fairbanks Morse	38-O/P	1200	2	1936
225	General Motors	6-71	2100	2	1943
150	Superior	GDB-8	1200	4	1942/44
90	Hercules	DWXDS	1800	4	1943

DIESEL GENERATOR SETS

AC	200 KW	3/60/450	1200 RPM	General Motors	8-268A	1943 | Rebuilt
	100 KW	3/60/450	1200 RPM	General Motors	3-268A	1943 | 1948
DC	1200 KW	525V	750 RPM	General Motors	16-278A	1943
	650 KW	240V	750 RPM	General Motors	12-567	1943
	290 KW	120/240	1200 RPM	General Motors	8-268A	1944
	125 KW	120/240	600 RPM	Superior	VDMB	1944
	100 KW	120/240	1200 RPM	Superior	GDB-8	1942/44
	100 KW	120/240	1200 RPM	General Motors	3-268A	1943/44
	60 KW	120V	1200 RPM	Buda	909	1942
	10 KW	120V	1200 RPM	Hercules	DOOD	1943

Ask for our new 1949
CATALOG
just off the press

MOTORS—D.C.

1500 HP 525 V DC 600 RPM Whse.
667 HP 374 V DC 1300 RPM Elliott.
444 HP 250 V DC 900 RPM Elliott.
222 HP 230 V DC 3050 RPM Whse.
15 HP 120 V DC 500 RPM Diehl

WRITE OR CALL FOR DETAILS

HUGO NEU CORPORATION

31 Nassau Street New York 5, N. Y.
Tel. REctor 2-1334

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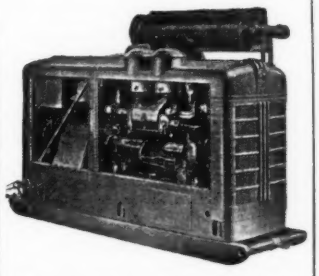
NEW

60 KW GMC DIESEL SETS

FOR IMMEDIATE DELIVERY



These fully-portable, self-contained units are offered at considerably less than manufacturer's list prices.

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FOR COMPLETE INFORMATION

OTHER NEW UNITS AVAILABLE
FROM 10 KW TO 50 KW

A. G. SCHOONMAKER CO., INC.
52 Church St., New York 7, N. Y.

Quality SINCE 1906 **Wente Motors**

WIDE SELECTION UNUSUAL VALUES

THEIR ELECTRICAL CONSTRUCTION HAS BEEN REBUILT . . . BY EXPERTS

SQUIRREL CAGE

3 ph.—60 cy.—220 or 440 V.
(Other voltage as noted)

Qu.	HP	Make	Type	Speed
1	50	Al. Ch.	1 (2200 V.)	900
2	50	Al. Ch.		900
1	60	G.E.	KT	1800
4	60	G.E.	KT (2200 V.)	1200
1	60	Reliance	AA	900
1	100	G.E.	I-16	450
1	100	G.E.	KT (2200 V.)	900
4	100	G.E.	K (TEFCBB)	1200
1	110	G.E.	KTP	1800
1	120	G.E.	FT	3600
2	125	Cr. Wh.	126Q	450
8	125	Al. Ch.	AR	450
2	150	Al. Ch.		1750
1	250	G.E.	I-17	900
1	250	G.E.	KP (Vert.)	3600

SLIP RING—SYNCHRONOUS

3 ph.—60 cy.—220 or 440 V.
(Other voltage as noted)

50	Al. Ch.		520
50	Al. Ch.		720
50	Ideal	AV	600
50	G.E.	I	700
60	Ideal	AVX	1200
75	West.	CW	400
75	G.E.	I	420
75	Fair. Morse	BV (2200 V.)	1800
100	G.E.	TRB	600
100	G.E.	I-16 (2200 V.)	450
100	West.	CW (S. P.)	1800

Qu.	HP	Make	Type	Speed
1	100	KW G.E.	ATB (8 PF)	900
1	125	Fair. Morse	T (2400 V.I.O PF)	900
1	150	G.E.	TS (8 PF)	1800
1	200	G.E.	TRC (8 PF)	400

D.C.—230 Volt
(Other voltage as noted)

1	50	West.	8K	850
1	50	G.E.	CD 1341	500/2000
3	50	Reliance	T	2700
1	50	West.	8K (115 V.)	500
1	60	West.	8K (115 V.)	500/1500
1	75	Diehl	K11	700
1	90	Cr. Wh.	CMC	225/550
1	100	West.	8K	850
1	100	Cr. Wh.	CM	600
1	130	Cr. Wh.	CMC (850 V.)	1200
1	150	West.	8K	850
1	180	Cr. Wh.	CMC	450

M-G SETS

1— 45 KW West. 60 V DC—440 V AC 1200 RPM
4— 60 KW G.E. 60 V DC—440 V AC 1200 RPM
3— 75 KW El. Mach. 230 V DC—440 V AC
1200 RPM
2— 75 KW El. Prod. 220 V DC—440 V AC
1200 RPM
1—100 KW Ridge. 250/275 V DC—440 V AC
1200 RPM
1—105 KW Century 70 V DC—440 V AC
1200 RPM
1—150 KW G.E. 250/275 V DC—440 V AC
900 RPM

ALSO—*4000 motors other than listed from 1 HP to 800 HP*

Wente S. C. 1906 *The Wente Electric Co.,*
Hamilton 203 NO. FOURTH ST. Phone 4-8128 *Ohio*

LAY-TYPE BOILERS FOR IMMEDIATE SHIPMENT!

1—650 H.P. Casey Hedges Straight Tube Boiler, 225 psi, new 1932. (BARGAIN)

1—560 H.P. Vogt, Class ML-3 drum Boiler, 200 psi, with chain grate stoker, combustion controls, new 1935.

1—410 H.P., B & W Stirling Boiler, 200 psi, new 1933.

1—340 H.P. Vogt, 4 drum Boiler, 200 psi, new 1931.

WRITE WIRE PHONE WAbash 6026

SEE Fletcher FIRST!

FLETCHER SALES CO.

325 Fincastle Building LOUISVILLE, KY.

DIESEL GENERATOR PLANTS

COMPLETE WITH SWITCHBOARDS

1000 KW to 100 KW

STATIONARY and PORTABLE

AT GREATLY REDUCED PRICES

NEW UNIT GUARANTEE

HERCULES ELECTRIC MACHINERY and EQUIPMENT CO.

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Cable Address HEMCOY Compton, Calif.

DIESEL POWER PLANT

1—200 KW, 400 RPM Buckeye

1—100 KW, 400 RPM Buckeye

Complete with switch gear and all accessories. GM Power Units for shovels, gravel plants, etc.

Attractive prices. *Immediate delivery.*

ROBERT L. NEISWANDER

LIMA, OHIO

Cable Address: OHIODIESEL

NEW COAL HANDLING PLANT

150 ton per hour, Jeffrey, complete with crushers, conveyors, hoppers, feeders to handle run of mine bituminous coal.

NEW COAL PULVERIZERS

4—Babcock & Wilcox Model E35, 9000# per hour cap. at 57 grindability.

ALL ABOVE EQUIPMENT MANUFACTURED 1947-8

OFFERED AT A SUBSTANTIAL DISCOUNT

Heat and Power Co., Inc.

70 PINE STREET DIGBY 8-0373 NEW YORK 5, N. Y.

FOR SALE

NEW UNUSED POWER EQUIPMENT

1—400 HP Hydraulic coupling for adjustable speed fan drive with 400 HP, 2300 volt, 900 RPM, 3 phase, 60 cycle motor and starter.

1—1200 PSI Boiler Feed Pumps, six stage Worthington type 4-UX-2, 3570 RPM, 500 GPM with 200 HP, 3 phase, 60 cycle motor and starter.

2—Chapman 6 inch List 901 Welding End, cast carbon chrome Molybdenum steel swing check valves with 18-8 stainless trim.

ALSO 1—Used 35-ton Railroad Crane — steam type

CORNELL UNIVERSITY

Purchasing Dept. ITHACA, N. Y.

FOR SALE

One 125 H.P. Amsteam generator built for 125# steam working pressure and arranged for operation with No. 6 oil, gas ignition with 220 volt 60 cycle, 3 phase alternating current.

This generator was originally built in 1947 and is in operation at the present time. It may be inspected at the plant of the Colonial Preserves, 1700 Elmwood Avenue, Buffalo, New York. Address ESTATE of A. J. ABELS, Robert S. Abels and Ward B. Arbury, Executors, 804 Morgan Building, Buffalo 2, New York.

SPECIAL TRANSFORMERS—YOUR SPECIFICATIONS

NEW TRANSFORMERS
OIL COOLED
AIR COOLED
PHASE CHANGERS

ARROW TRANSFORMER CO., INC.
1932 E. Westmoreland St., Philadelphia 34, Pa.
GArfield 5-0488

USED TRANSFORMERS
REWOUND
REBUILT
RECONDITIONED

FOR SALE BY CITY OF LEBANON, MISSOURI

1—400 H.P. Erie City Boiler 200# P.S.I. ASME—with Fryr Spreader Stoker and Forced Draft Fan—in service—1937—18,000# capacity—excellent condition—on foundation bid desired for late summer removal.

1—Six panel Westinghouse Switch gear (600-400-200-200-150-100 amps) 2400 volt, 60 cycle completely equipped—Available July or August.

B. W. JOHNSON, *City Manager*

FOR SALE

GEAR TRANSMISSION

300 HP Sturtevant

2515 to 900 RPM Design #3

ELECTRIC APPARATUS REPAIR CO.

1400 No. 6th St., Phila. 22, Pa.

SEARCHLIGHT SECTION

SLIP RING MOTORS

3-Ph., 60 Cy.

HP	Volts	Make	Speed
450	440/220	Whse.	514
300	2200/550	G.E.	900
250	2200/440	Whse.	600
200	440/220	Whse.	514
200	440/220	Whse.	900
200	2200/440	G.E.	1200
200	440	G.E.	450
150	440/220	Whse. (2)	1800
150	2200/440	G.E.	1200
150	440/220	G.E.	720
100	440/220	G.E.	600
100 (2)	440/220	Whse.	900
100	2200/550	G.E.	1800
80	440/220	G.E. (MTC)	900
75	2200/550	G.E.	1800
75	440/220	Whse. 25 cy.	750

SYNCHRONOUS MOTORS

3-Ph., 60 Cy.

HP	Volts	Make	Type	RPM
400	440/220	G.E.	ATI	600
300	2200/440	G.E.	TS	720
300	440/220	G.E.	ATI	600
250	440/220	Whse.	HR	277
250	440/220	G.E.	ATI	600
240	440/220	Whse.	G	1800
200	440/220	G.E.	TS	720
200	4150/2300	Whse.	G	1800
120	440/220	G.E.	ATI	900
110	440/220	G.E.	TS	257
100	440/220	Whse.	G	1800
75	2200/440	Whse.	GE	600

GENERATOR SETS

1—62½ kva. 1200 rpm, 220 volt, Whse., geared to 7300 rpm, Whse., non-cond. steam turbine, 150 lbs. pr.
2—unused 25 kva. 120/208 v., 3 ph., 1200 rpm, generator dir. conn. to Waukesha 6 cyl. gas engine.

AIR COMPRESSOR UNIT

1—13" and 8" by 10" Worthington FEATHER-VALVE, 285 rpm. 110 lbs. gas. motor-driven.

CIRCUIT BREAKERS

3—2000 amp., GG E, 3 pole, 600 v., air
2—1600 amp., ITE, 3 pole, 600 v., air
2—1200 ampere, Whse, 3 pole, 600 v., air

SQUIRREL CAGE MOTORS

HP	Volts	Make	Type	Speed
500	440/220	G.E.	IK	900
400	550	G.E.	IK	720
300	2200/550	Whse.	CS	1800
250	2200/440	L. Allis	OGS	1200
200	440	G.E	IK	514
200	440/220	Whse.	CS	1200
200	440/220	G.E.	KT	1800
200	2200/440	G.E	KF	720
200	2200/550	Cr. Wh.	SC	900
200	2200/440	G.E.	KT	1200
200	440/220	G.E.	IL	450
150	440/220	G.E.	IK	450
100	2200/550	Whse.	CS	900
150	440/220	G.E.	KT	720
150	440/220	Howell	B Brg.	1800
150 vert.	440/220	G.E.	KTP	1200
150	440/220	G.E.	IK	514
125	440/220(2)	G.E.	IK	514
125 vert.	440/220	G.E.	KTP	1200
100	550	Cr. Wh.	Q	900
100	2200/440	G.E	K	1200
60	440/220 (new)	L. Allis	OGA	1800

A. C. GENERATORS

1—500 kva, 1200 rpm, 2300/440 v., G.E.
1—300 kva., 600 rpm., 440/220 v., G.E.
1—250 kva., 720 rpm., 2300/440v., G.E.
1—250 kva., 600 rpm., 2200/440 v., G.E.
1—225k va., 600 rpm., 220/440 v., G.E.
210 kva. 1800 rpm, 440/220 volt, Westinghouse
100 k/a. 100 rpm. 440/220 volt, Westinghouse
1—112 kva 900 rpm., 440/220 v., G.E.
2—75 kva 1800 rpm., 440/220 v., Whse.

D. C. MOTORS

HP	Volts	Make	Type	Speed
350	230 (2)	G. E.	CD	1150
250	230 (2 new)	Cr. Wh.	CMC	1800
200	230	Cr. Wh.	CMC	890
150	230 (new)	Cr. Wh.	TEFC	900
100	230	Cr. Wh.	CMC	925
100	230	G.E.	CD	1750
75	230	G.E.	CD	1150
75	230	Whse.	SK	850

MOTOR GENERATOR SETS

1—250 kw. 1200 rpm, 250 v., 3 wire, conn. to 500 hp 1200 rpm, 2300/440v., G.E. syn.
1—165 kw, 6 ph., 1200 rpm., 250/125 v., G. E. rotory converter complete trfmsformers, etc.
1—165 kw, 1200 rpm, 240 v., G.E., conn. to 250 hp, 1200 rpm, 440/220 v., squirrel cage
1—150 kw, 900 rpm, 240 v., Cr. Wh., conn. to 225 hp, 900 rpm, 2200/550 v., squirrel cage.
1—125 kw, 1200 rpm, 250/120 v., G.E., conn. to 175 hp, 1200 rpm, 4000/2300/440 v., synchronous
1—75 kw., 125 v., 1200 rpm., G.E. conn. to 120 hp., 2300/440 v., syn. motor.
1—50 kw., 250 1200 rpm., G.E. conn. to 75 hp., 440/220 v., 60 cy., G.E. syn. motor.

TRANSFORMERS

60 Cy.

3— 500 kva, Al. Chal, 2400-480 v.
1— 400 kva., G.E. 2300-230/115
3— 250 kva, G.E., 2400—240/480 volts
3—250 kva, G.E., 13800—230/460 volts
3—200 kva, Moloney, 4150/7200Y—120/240 volts
2— 150 kva., G.E., 13800/6900—110/220 v.
1— 150 kva., Whse. SK, 13200-125/215 v., 3 ph
3— 150 kva., G. E., 2300—230/460 volts
3— 100 kva, G. E., 138 80—230/115 v. NEW
6— 100 kva., G.E., 4600/2300-230/115. NEW.
3— 100 kva., G.E., 450-115/230 v., dry, 1 ph., new
4—100 kva, G.E., 440/220—220/110 v.
2— 75 kva., G.E., 2400-240/120 v.
3— 75 kva., G.E., H-KF, 2300-230/460 v

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HARRY J. RICE PRES.

458 SEVENTH ST. HOBOKEN, N. J.

NEW MOTORS

IMMEDIATE SHIPMENT

30%

DISCOUNT

G.E., WEST., ALLIS CHALMERS, RELIANCE, CENTURY, ETC.

From 1 HP to 300 HP
1, 2, & 3 Phase

All Speeds — All Voltages

Open, Drip Proof
Splash Proof, T.E.F.C., Exp. Pr.

Large stock of rebuilt transformers, motor generators, etc. *Write, Wire or Phone.*

ELECTRIC EQUIPMENT COMPANY

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FOR SALE

MODERN 1000 KW Turbo-Generator

In Excellent Condition

Non-Condensing, Steel case 80# back pressure .8 P.F., 3 phase, 60 cycle, 4150/2300 volts, alternating current, complete with accessories, switchboard, oil circuit breaker, and direct connected exciter. Only operated alternately for six years. Ideal for Chemical, Rubber, Petroleum, Textile, Pulp and Paper, and Sugar Refining Industries.

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FOR SALE

600 tons of Splash Dam coal weekly, R O M only.

ANALYSIS:

Moisture	0.71%
Volatile matter	29.30"
Fixed Carbon	65.59"
Ash	4.40"
Sulphur	0.81"
B. T. U. Det.	14,424

Shipping point, GRUNDY, BUCHANAN COUNTY, VIRGINIA. *Address all correspondence to* J. G. BUSTON, TAZEWELL, VIRGINIA.

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4000 KW TURBINE GENERATING PLANT

Consisting of

1—2000 KW and 2—1000 KW General Electric, 3 phase, 60 cycle, 480 Volts, 3600 R.P.M. Condensing Turbo Generator Units. Complete with all Auxiliaries. General Electric inspection reports are available.

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2—1250 KVA CROCKER WHEELER—NEW ALTERNATORS DIRECT CONNECTED TO FAIRBANKS MORSE MODEL 38D8—⅛—1600 HP—720 RPM—DIESEL ENGINES.
2— 938 KVA ELECTRIC MACHINERY NEW GENERATORS. 3—602300 VOLT DIRECT CONNECTED TO GENERAL MOTORS MODEL 12-567-ATL DIESEL ENGINES.
2— 625 KVA WESTINGHOUSE 3-60-2300 VOLT—NEW ALTERNATORS DIRECT CONNECTED TO GENERAL MOTORS MODEL 12-567-ATL—850 HP AT 720 RPM—DIESEL ENGINES.
4— 125 KVA WESTINGHOUSE—3-60-450 VOLT—GENERATORS DIRECT CONNECTED TO GENERAL MOTORS MODEL 3-268A—150 HP—1200 RPM—DIESEL ENGINES
2— 620 KW 240 VOLT—DC—GENERAL ELECTRIC GENERATORS DIRECT CONNECTED TO ALCO TYPE 6—12½x13-T—900 HP—700 RPM—DIESEL ENGINES.
2— 100 KW 120-240 VOLT—3 WIRE—DELCO GENERATORS DIRECT CONNECTED TO GENERAL MOTORS MODEL 3-268A—150 HP—DIESEL ENGINES.

ENGINES NEW LATE 1944—RELATIVELY FEW HOURS OPERATION

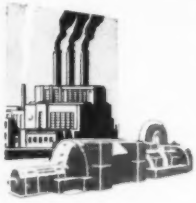
DEPT. B

WALTER H. WILMS & COMPANY

2526 GUARDIAN BUILDING DETROIT 26, MICHIGAN

Phone: Woodward 1-1856 and 1-1857

SEARCHLIGHT SECTION



PROCESS TURBO GENERATORS

Item 1769 625 KW non condensing Westinghouse built 1931. 125# ISP, 20# GBP. 2300 Volts.
Item 432 500 KW extraction Moore built 1929. 150# ISP. 15# extr. 440 Volt.
Item 1005 1500 KW extraction GE built 1920, rebuilt and rewound 1942. 150# 550 degrees ISP, 15# extr. 440 volt.

CONDENSING TURBO GENERATORS

Item 62 300 KW built 1929 rebuilt rewound by Westinghouse 1945. 150# ISP. 120/208 Volts.
Item 2080 750 KW GE never installed. 440# 700 degrees ISP. 440 volts.
Item 1016 1250 KW Allis Chalmers built 1924. 200# ISP. 2300 volt.
Item 3049 2000 KW GE entirely rebuilt. 150# ISP. 2300 volts.

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Item 1777 (3) modern 220 HP Vogt 3 drum. 160#. Gas and oil fired.
Item 1671 (1) Erie City 3 drum 210 HP built 1942. 200#. No firing equipment.
Item 2121 (1) Union 3 drum 535 HP built 1930. 200# 100 degrees Sh. Pulverized coal.
Item 2022 Complete Plant 270# working pressure all gas fired. 3—1000 HP Vogt Boilers installed 1943 and 2—800 HP B and W Integral furnace boilers, installed 1946 with all auxiliaries.

OHIO AND NATIONAL BOARD SCOTCH MARINES

Item 2000 Coal Fired: (1) 89 HP 125# and (1) 100 HP 125#. Oil fired: (1) 29 HP 125# and (1) 29 HP 250#.

TRANSFORMERS

Item 2120 1000 KVA 3 phase 13800/24000 to 480. OISC. Outdoor. New 1942 Standby to 1946. Light load to 1949.

PAUL STEWART
CINCINNATI, OHIO.

MAIN 5873 UNION TRUST BUILDING MAIN 3427

FOR SALE
USED BOILERS

3—10,000' American Red Flash Heating
1—30 HP Scotch Marine, 100# hand fired
4—90 HP locomotive fire box 200#
4—110 HP locomotive fire box 200#
2—150 HP locomotive fire box 150#
2—150 HP Scotch Marine 150# oil firing
1—250 HP B&W water tube 170#
2—150 HP H.R.T. 150#
1—505 HP Brose water tube 200#
1000 AC-220 Turbine Gen.

Full information upon request

National Boiler & Equipment Co.
1501 S. Senate Avenue
Indianapolis 25, Indiana

FOR SALE

3—D8800 CATERPILLAR DIESEL ELECTRIC SETS

Equipped with 75 KW Louis Allis Generators rated at 62.5 KVA continuous load, gasoline starting engines, oil coolers, Woodward Governors, 220 Volt, 3 Phase, 60 Cycle—complete with switchboard, synchronizing units, Wstinghous Circuit Breakers, Voltmeter—frequency meter, Watthour and Kilowatt Meter.

All in good condition and can be seen in operation in manufacturing plant in midwest. Reasonably priced. Want to sell complete installation.

FS-9487, POWER
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VALVES & FITTINGS
Steel—Iron—Brass
Industrial & Marine Piping Supplies
"If it's a valve, we have it"
H. P. SHERMAN COMPANY
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EVergreen 9-3300

CRANKSHAFT

for Fairbanks-Morse model 38D8-1⅛ OP Diesel Engine. New, packed in oil, in original case.

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31 NASSAU STREET, NEW YORK 5, N. Y.

HOT WATER RECLAIMER

W.P. Shell 100 pounds—W.P. Tubes 20 pounds—24" dameter—12' long behind cast iron heads—solid copper shell and tubes—6" flanged inlet and outlet, both on one end—price $2500.00; "where is and as is."

CAROLYN LAUNDRY
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SEND your TRANSFORMERS to ELECTRIC SERVICE CO., INC.

A financially responsible organization specializing in buying, selling, repairing, rewinding and redesigning transformers only.

Experienced personnel assures you first class workmanship and complete satisfaction.

Every transformer guaranteed for one year

The Electric Service Co., Inc.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
MARIEMONT Since 1912 CINCINNATI 27, OHIO

FOR SALE

TERRY STEAM TURBINE
220 H.P.—2000 R.P.M.
120 P.S.I.—5 Lbs. back
L. T. ROBINSON
P. O. Box 1555 Youngstown, O.

WANT TO BUY *NEW SURPLUS*
VALVES & PIPE FITTINGS

EAST COAST VALVE & FITTING CO., INC.
725 FIFTH AVENUE BROOKLYN 32, N. Y.

WANTED

WANTED

150 or 200 HP motor 3 ph. 60 cy. 720 or 900 RPM Metal-clad switch gear panels for 2300 volt operation. Circuit Breakers for 2300 volt service with interrupting rating of 100,000 KVA or more. Steam Turbine—4600 KW. Destroyer Escort Marine Type. Transformers 200 to 500 KVA—2300-440-220—can use some units with damaged coils for rewinding purposes.

RM 4200, 141 W. JACKSON BLVD.
CHICAGO 4, ILLINOIS

BUYERS OF SURPLUS COPPER INSULATED WIRES AND CABLES
No lengths too long or too short
TELEPHONE: EASTGATE 7-4778
PIERCE CABLE CO.
2668 CLYBOURN AVE., CHICAGO 14, ILLINOIS

WANTED

Vertical engine generator set, 125#-150# pressure, 5# back pressure, 600-KW, 480 V. 60 cy., 3 phase.

LOUISVILLE COOPERAGE CO.
Louisville 8, Ky.

WANTED

STEAM TURBINE, one 50 HP preferably Terry, for operation on 125 P.S.I. Steam, 10 P.S.I. back pressure.

THE UNION METAL MFG. CO.
Canton 5, Ohio

SYNCHRONOUS MOTOR
WANTED

250 or 300 H.P., 3 ph., 60 cyc., 208 V or reconnectable to that voltage. Induction motor same characteristics might be acceptable.

ROSELAND
1658 BROADWAY NEW YORK

Air Compressors Wanted

Horizontal Water Cooled—Any size
also 2 Stage portable units

L. W. BAUER
North Bergen, N. J.

WANTED

SALES ENGINEER to check and follow up repair business on water wheels. In reply state experience, technical education and salary desired.

HOLYOKE MACHINE COMPANY
HOLYOKE, MASS.

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received by August 11th will appear in the September issue, subject to space limitations. *Classified Advertising Division*
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Most all units still on foundation. Many may be seen operating

TURBO UNITS (Cond.)
1625 KVA Wghse. 3-60-2300 v. Bleeder
1250 KVA GE 3-60-440 v.—Bleeder
1250 KVA (2) Elliott 480/240 v.
1250 KVA (2) General Electric 2300/4150 v.
1250 KVA (2) General Electric 480 v. (bleeder)
750 KVA General Electric 2300 v.
750 KVA General Electric 220/480 v.
625 KVA General Electric 2300 v.
375 KVA General Electric 2300 v.

TURBO UNITS (Non-Cond.)
625 KVA GE 480/240 v., 30/50# BP
625 KVA General Electric 2300 v.
375 KVA (2) GE 2300/440/220 v.
250 KVA General Electric 600 v.
62½ KVA, 112 KVA, 125 KVA, 200 KVA and 250 KVA GE 480/220 v. units.

DIESEL UNITS
375 KVA FM 480/240 v. (Model 32E-14)
156 KVA Ideal 240/480 v.—Buckeye
125 KVA GE 240/480 v.—Superior
93 KVA GE 480/240 v.—Superior
75 KVA GE 240/480 v.—General Motors
50 KVA FM 240/480 v.—Model 36-A
37 KVA (3) General Motors 240/480 v. (NEW)
Gas Unit—375 KVA GE 480 v.—Cooper Bessemer Gas

BOILERS
623 HP Vogt 4 drum 450#, Chain Grate Stoker
605 HP Union 3 drum 200#
507 HP Combustion 400#
488 HP Heine 250#
400 HP (2) Casey Hedges box header, 200#, Completely overhauled
255 HP B&W 3 drum 200#
200 HP Erie City 3 drum 160#
110 HP Erie City 3 drum 180#
280 HP Combustion HRT 150#
106 HP Ames "Economic" 125#
214 HP Kewanee Loco. type 125#

STEAM ENGINE SETS, A.C.
1125 KVA GE-Nordberg Uniflow
500 KVA GE-Skinner Uniflow
315 KVA Wghse.-Ames Uniflow
312 KVA (2) CW-Skinner Uniflow
312 KVA GE-Chuse 4 valve
312 KVA GE-Ames Uniflow
250 KVA (2) GE-Skinner Uniflow
187 KVA CW-Skinner Uniflow
187 KVA Wghse.-Ames Unif. (vertical)
187 KVA GE-Chuse 4 valve

PUMPS — MOTOR DRIVEN

COMPRESSORS — MOTOR DRIVEN

TRANSFORMERS

MOTOR GENERATOR SETS

POWER PLANT EQUIPMENT CO., INC.

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New York, N. Y.

FOR SALE

10 Ton Outside Crane and Runway
80 ft. Span—410'—long.
A.C. Current

10 Ton P. & H. Crane 31'—
Span A.C. Current—30' Lift

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2017 Preble Ave., Pittsburgh 12, Pa.

FOR SALE

1000 KW G.E. Turbo unit and condenser
500 KVA Wghse. Turbo unit and condenser
Two 2000 Gal. centrifugal pumps and motors
10,000 lb. per hr. deaerating feed water heater
I-R Compressor 20,000 cfm at 100# pressure
Motor-driven Blower—60,000 cfm at 4 lbs. pressure
2 motor generator sets 30 KW 125V output
600 HP 12 cylinder Hall Scott motor with clutch

ROOM 4200
141 W. JACKSON BLVD.
CHICAGO 4, ILL.

For Sale

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ELECTRICAL EQUIPMENT

IMMEDIATE DELIVERY

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(3 PHASE — 50 CYCLE)

QUAN.	HP	VOLTS	RPM
1	600	3000	600
2	75	220/380	2970
1	60	220/380	2970
2	50	220/380	2970
1	30	220/380	2960
1	25	220/380	1480
2	20	220/380	2960

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ALSO MANY NEW SPARE PARTS

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Sterling 3-6515

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2—1000 & 2—10,000 Bbl. New Vertical
6—74,000 & 35,000 Bbl. Vertical
8—25,000 Gal. Cap. Horizontal
50—10,000 & 3—20,000 Gal. Horizontal
6—10,000 & 12,000 Gal. ⅜" Shell
20—10,000 Gal. Cap. 60 lb. Press. Test

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150 H.P. Ames "Economic" type H.R.T. boiler 125 p.s.i. working pressure complete with grates and steel smoke stack. Can be oil fired. Insured and in good operating condition. No reasonable offer refused.

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FOR SALE

IMMEDIATE DELIVERIES
REASONABLE PRICES

AC DIESEL GENERATORS

Several 1000 KW, 2300V, Fairbanks Morse, O.P., 720 RPM w/New Elliott or Crocker Wheeler Generators.
Several 600 KW, 2300V, G.M.C., 12 cyl., 720 RPM, w/New Crocker Wheeler Generators.
1—500 KW, 2300/480V, G.M.C., 12 cyl., 720 RPM, w/G.E. Generator.
Several 400 KW, 2300/480V, Baldwin, 6 cyl., 450 RPM, w/New EMCO Generators.
1—300 KW, 240/480V, G.M.C. 8 cyl., 1200 RPM.

DC DIESEL GENERATORS

1—610 KW, Cooper Bessemer, 8 cyl., 950 H.P. w/G.E. 500V, 750 RPM Generator.
10—300 KW, Baldwin-Westinghouse, 120/240V, 3 wire, 440 HP, 400 RPM. Like New.
2—300 KW, G.M.C., 8-268A, 120/240 volt, 3 wire, 1200 RPM.
Several 100 KW, GMC, 3-268A, w/Allis Chalmers, 120/240V, 3 wire Generators.
Several 100 KW, Superior, 8 cyl. w/Delco, 120/240V, 3 wire Generators.

Subject Prior Sale

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220 Hudson Street, Seattle 8, Wash.
Lander 9311

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3"—600# Crane Flanged Valves

15 HP to 40 HP Good Used Motors 550 Volt, 3 Phase, 60 Cycle

18" x 8 ft. Hendey Lathe

20" x 8 ft. Lodge & Shipley Lathe

18" x 10 ft. South Bend Lathe

8" Cochrane Oil Separator

MERRIMAC HAT CORPORATION
AMESBURY, MASS.

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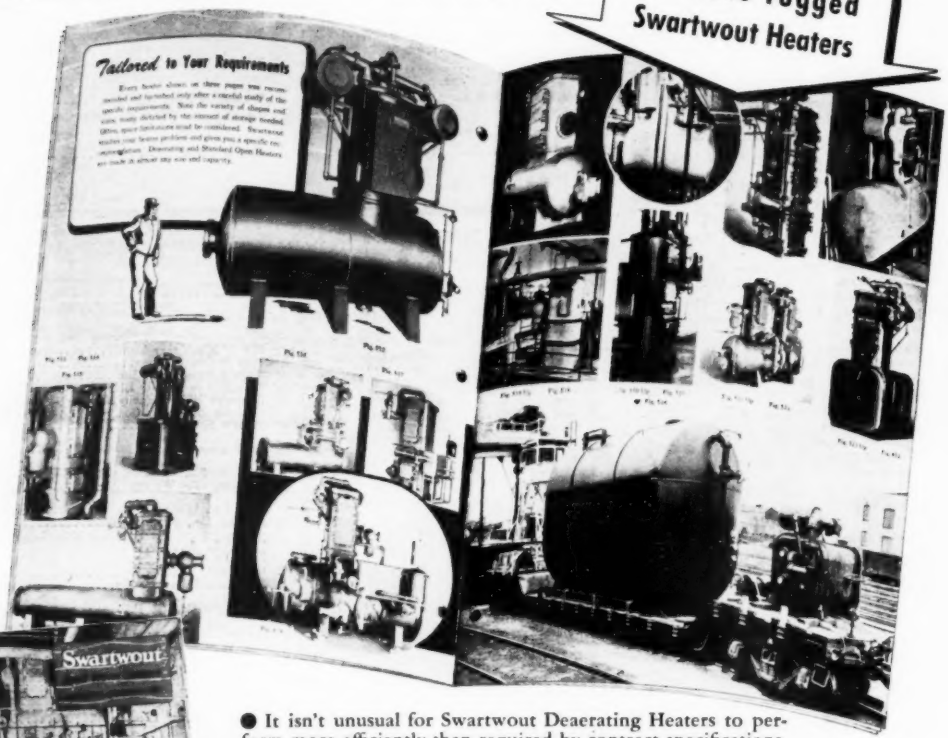

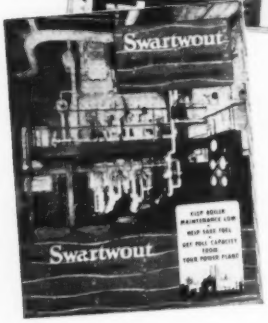

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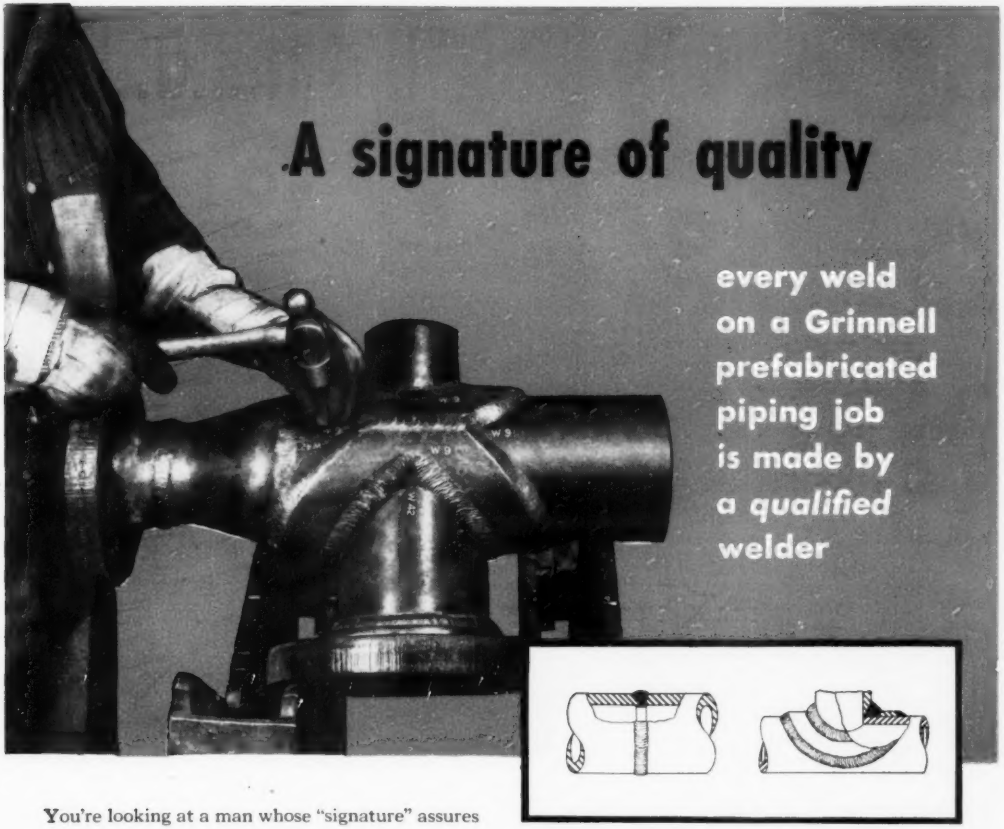
THE SWARTWOUT COMPANY • 18511 Euclid Ave., Cleveland 12, Ohio



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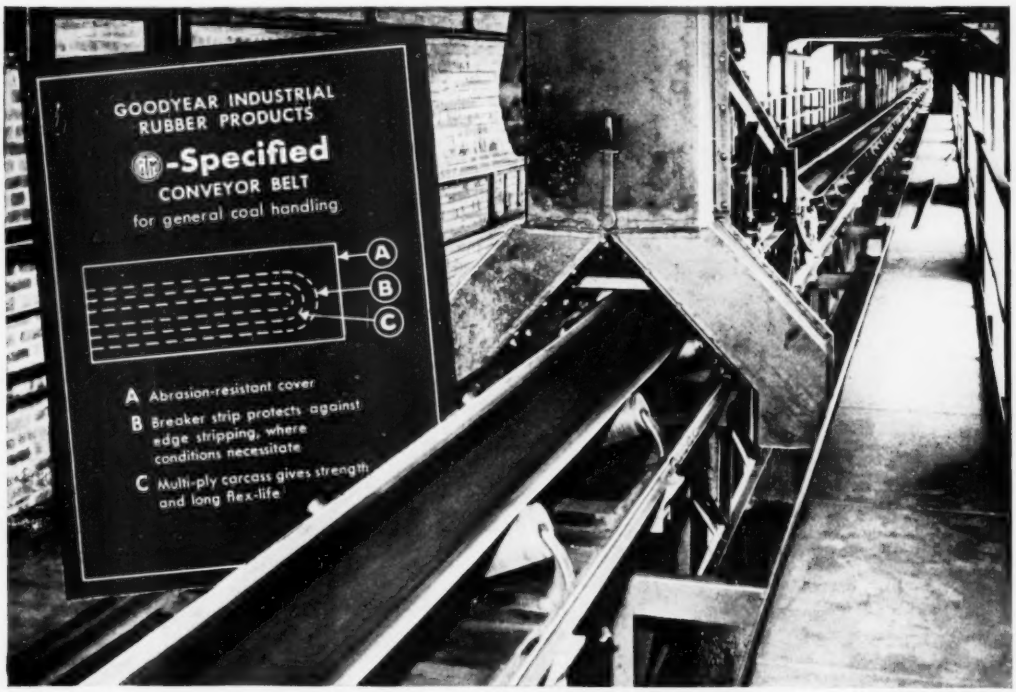

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